



TESTREPORT

Applicant Name : Shenzhen Omni Intelligent Technology Co., Ltd.
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Report Number: RA230504-23399E-RF-00B
FCC ID: 2AI2O-M136IOT

Test Standard (s)

FCC PART 27; FCC PART 22H; FCC PART 24E

Sample Description

Product Type: sharing bike IOT controller
Model No.: M136-IOT
Multiple Model(s) No.: N/A
Trade Mark: N/A
Date Received: 2023/05/04
Report Date: 2023/05/25

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Approved By:

Andy Yu
EMC Engineer

Candy Li
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

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Page 1 of 72

FCC -2G,3G,4G

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY	3
GENERAL INFORMATION	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
TEST METHODOLOGY	4
MEASUREMENT UNCERTAINTY	5
TEST FACILITY	5
SYSTEM TEST CONFIGURATION	6
DESCRIPTION OF TEST CONFIGURATION	6
EQUIPMENT MODIFICATIONS	6
SUPPORT EQUIPMENT LIST AND DETAILS	6
SUPPORT CABLE DESCRIPTION	6
BLOCK DIAGRAM OF TEST SETUP	7
SUMMARY OF TEST RESULTS	8
TEST EQUIPMENT LIST	9
FCC §15.247 (I) & §1.1307 (B) (3) & §2.1091- MPE-BASED EXEMPTION	11
FCC §2.1047 - MODULATION CHARACTERISTIC	13
FCC §2.1046, §22.913 (A) (D)& §24.232(C) (D); §27.50(C)(D)- RF OUTPUT POWER	14
APPLICABLE STANDARD	14
TEST PROCEDURE	14
TEST DATA	14
FCC §2.1049, §22.917, §22.905 & §24.238& §27.53 - OCCUPIED BANDWIDTH	26
APPLICABLE STANDARD	26
TEST PROCEDURE	26
TEST DATA	26
FCC §2.1051, §22.917(A) & §24.238(A)& §27.53 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS	48
APPLICABLE STANDARD	48
TEST PROCEDURE	48
TEST DATA	48
FCC §2.1053; §22.917 (A); §24.238 (A); §27.53- SPURIOUS RADIATED EMISSIONS	54
APPLICABLE STANDARD	54
TEST PROCEDURE	54
TEST DATA	54
FCC §22.917 (A); §24.238 (A); §27.53 (G) (H)- BAND EDGES	60
APPLICABLE STANDARD	60
TEST PROCEDURE	60
TEST DATA	60
FCC §2.1055; §22.355; §24.235; §27.54 - FREQUENCY STABILITY	67
APPLICABLE STANDARD	67
TEST PROCEDURE	67
TEST DATA	68

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230504-23399E-RF-00B	Original Report	2023/05/25

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	WCDMA Band 2: 1850-1910MHz(TX); 1930-1990MHz(RX) WCDMA Band 5: 824-849MHz(TX); 869-894MHz(RX) LTE Band 2: 1850-1910MHz(TX); 1930-1990MHz(RX) LTE Band 4: 1710-1755MHz(TX); 2110-2155MHz(RX) LTE Band 12: 699-716MHz(TX); 729-746MHz(RX)
Modulation Technique	3G: BPSK, QPSK, 16QAM 4G: QPSK, 16QAM
Antenna Specification*	WCDMA Band 5: -0.87dBi WCDMA Band 2/ LTE Band 2: -1.25dBi LTE Band 4: -0.86dBi LTE Band 12: -0.72dBi (provided by the applicant)
Voltage Range	DC 3.7V from battery or DC 30-72V from External power supply
Sample serial number	25BM_2 for Radiated Emissions Test 25BM_1 for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition
Extreme condition*	L.V.: Low Voltage 3.52V _{DC} N.V.: Normal Voltage 3.7V _{DC} H.V.: High Voltage 4.07V _{DC} (provided by the applicant)

Objective

This test report is in accordance with Part 2-Subpart J, Part 22-Subpart H, Part 24-Subpart E, Part 27 of the Federal Communication Commission's rules.

The objective is to determine the compliance of the EUT with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability and band edge.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2-Subpart J as well as the following parts:

Part 22 Subpart H - Public Mobile Services
Part 24 Subpart E - Personal Communication Services
Part 27 - Miscellaneous Wireless Communications Services

ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		0.082×10^{-7}
RF output power, conducted		0.71dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Audio Frequency Response		0.1dB
Low Pass Filter Response		1.2dB
Modulation Limiting		1%
Emissions, Radiated	9kHz - 30MHz	2.06dB
	30MHz - 1GHz	5.08dB
	1GHz - 18GHz	4.96dB
	18GHz - 26.5GHz	5.16dB
	26.5GHz - 40GHz	4.64dB
Temperature		1°C
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the Floor 1, KuMaKe Building, Dongzhou Community, Guangming Street, Guangming District, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 30241.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The final qualification test was performed with the EUT operating at normal mode.

Test was performed as below table:

Frequency band	Bandwidth (MHz)	Test Frequency(MHz)		
		Low	Middle	High
WCDMA B2	4.2	1852.4	1880	1907.6
WCDMA B5	4.2	826.4	836.6	846.6
LTE B2	1.4	1850.7	1880	1909.3
	3	1851.5	1880	1908.5
	5	1852.5	1880	1907.5
	10	1855	1880	1905
	15	1857.5	1880	1902.5
	20	1860	1880	1900
LTE B4	1.4	1710.7	1732.5	1754.3
	3	1711.5	1732.5	1753.5
	5	1712.5	1732.5	1752.5
	10	1715	1732.5	1750
	15	1717.5	1732.5	1747.5
	20	1720	1732.5	1745
LTE B12	1.4	699.7	707.5	715.3
	3	700.5	707.5	714.5
	5	701.5	707.5	713.5
	10	704	707.5	711

Note: the EUT belong to LTE Category 1, for 16QAM modulation, maximum support 27RB.

Equipment Modifications

No modification was made to the EUT.

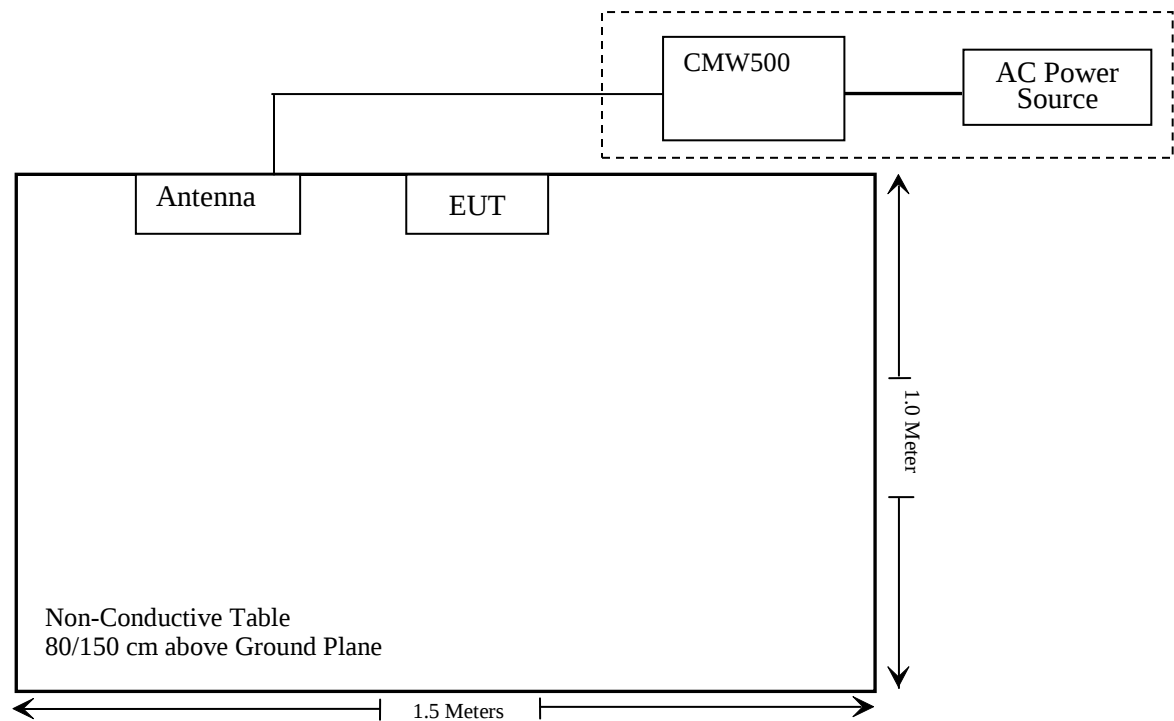
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	154606

Support Cable Description

Cable Description	Length (m)	From / Port	To
Unshielded Un-detachable AC cable	1.2	AC Power	CMW500

Block Diagram of Test Setup



Note: the support table edge was flush with the center of turntable

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 , §2.1091	RF Exposure	Compliant
§2.1046; § 22.913 (a) (d); § 24.232 (c) (d); §27.50 (c) (d)	RF Output Power	Compliant
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; § 22.905; § 22.917; § 24.238; §27.53	Occupied Bandwidth	Compliant
§ 2.1051; §22.917 (a); § 24.238 (a); §27.53;	Spurious Emissions at Antenna Terminal	Compliant
§ 2.1053; § 22.917 (a); § 24.238 (a); §27.53	Field Strength of Spurious Radiation	Compliant
§ 22.917 (a); § 24.238 (a); §27.53 (g) (h)	Band Edge	Compliant
§ 2.1055; § 22.355; § 24.235; §27.54;	Frequency stability	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Quinstar	Amplifier	QLW-184055 36-J0	15964001002	2022/11/08	2023/11/07
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.15	N600	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.16	N650	2022/11/25	2023/11/24
Unknown	Band Reject Filter	MSF824-862 MS-1147	ATCE-141	2022/11/25	2023/11/24
Unknown	Band Reject Filter	MSF1850-191 0MS-1148	ATCE-142	2022/11/25	2023/11/24
Unknown	Band Reject Filter	MSF1710-178 5MS-1150	ATCE-144	2022/11/25	2023/11/24
Unknown	Band Reject Filter	MSF700-800 MS-1153	ATCE-147	2022/11/25	2023/11/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-194	2023/02/14	2026/02/13
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-655	2022/12/26	2025/12/25
Schwarzbeck	Horn Antenna	BBHA9120D	837	2023/02/22	2026/02/21
PASTERNAK	Horn Antenna	PE9852/2F-20	1120 (ATC-BA-024-1)	2023/01/04	2026/01/03
PASTERNAK	Horn Antenna	PE9852/2F-20	1120 (ATC-BA-025-1)	2023/01/04	2026/01/03
Unknown	RF Coaxial Cable	No.16	N200	2022/11/25	2023/11/24
Agilent	Signal Generator	N5183A	MY51040755	2022/11/25	2023/11/24

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101948	2022/11/25	2023/11/24
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	110566	2022/11/25	2023/11/24
WEINSCHTEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Mini-Circuits	Power Splitter	DC-18000MHz	SF10944151S	2022/11/25	2023/11/24
BACL	Temp. & Humid. Chamber	BTH-150-40	30192	2023/02/09	2024/02/08
Fluke	Multi Meter	45	7664009	2022/11/23	2023/11/22
Manson	DC Power Source	KPS-6604	ATCS-205	NCR	NCR
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	

* Statement of Traceability: Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.247 (I) & §1.1307 (B) (3) & §2.1091- MPE-BASED EXEMPTION

Applicable Standard

According to subpart 1.1307 (b) (3) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

According to KDB 447498 D04 Interim General RF Exposure Guidance

MPE-Based Exemption:

General frequency and separation-distance dependent MPE-based effective radiated power(ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$.
1.34-30	$3,450 R^2/f^2$.
30-300	$3.83 R^2$.
300-1,500	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.

R is the minimum separation distance in meters

f = frequency in MHz

For multiple RF sources: Multiple RF sources are exempt if:

in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation:

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

Result

Mode	Frequency (MHz)	Tune up conducted power	Antenna Gain		ERP		Evaluation Distance (m)	ERP Limit (W)
		(dBm)	(dBi)	(dBd)	(dBm)	(W)		
BLE	2402-2480	0	0.58	-1.57	-1.57	0.001	0.2	0.768
WCDMA B2	1850-1910	25.0	-1.25	-3.4	21.6	0.145	0.2	0.768
WCDMA B5	824-849	24.0	-0.87	-3.02	20.98	0.125	0.2	0.422
LTE B2	1850-1910	20.0	-1.25	-3.4	16.6	0.046	0.2	0.768
LTE B4	1710-1755	21.5	-0.86	-3.01	18.49	0.071	0.2	0.768
LTE B12	699-716	23.0	-0.72	-2.87	20.13	0.103	0.2	0.358

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
 2. The BLE can Simultaneous transmitting with WWAN
 3. 0dBd=2.15dBi

Simultaneous transmitting consideration (worst case):

The ratio= $ERP_{BT}/limit + ERP_{WWAN}/limit$
 $=0.001/0.768 + 0.125/0.422 = 0.298 < 1.0$, so simultaneous exposure is compliant.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

FCC §2.1047 - MODULATION CHARACTERISTIC

According to FCC §2.1047(d), Part 22H & 24E& 27, there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

FCC §2.1046, §22.913 (a) (d)& §24.232(c) (d); §27.50(c)(d)- RF OUTPUT POWER

Applicable Standard

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC §2.1046 and §24.232 (c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB.

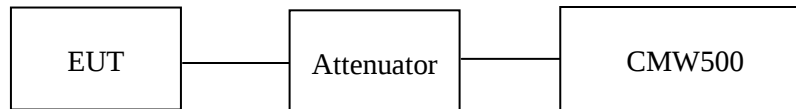
According to §27.50(c), Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

According to §27.50(d), Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

Test Procedure

Conducted method:

The RF output of the transmitter was connected to the CMW500 through sufficient attenuation.



Note: the path loss (cable loss and attenuator) has included in the result.

Test Data

Environmental Conditions

Temperature:	24~27 °C
Relative Humidity:	52~60 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang from 2023-05-14 to 2023-05-19.

Conducted Power**Cellular Band (Part 22H)**

Mode	Test Mode	3GPP Sub Test	Average Output Power (dBm)			ERP(dBm)		
			Low	Mid	High	Low	Mid	High
WCDMA (Band 5)	RMC12.2k		23.19	23.31	23.52	20.17	20.29	20.50
	HSDPA	1	22.13	22.24	22.42	19.11	19.22	19.40
		2	22.14	22.35	22.41	19.12	19.33	19.39
		3	22.24	22.36	22.45	19.22	19.34	19.43
		4	22.31	22.39	22.51	19.29	19.37	19.49
	HSUPA	1	21.74	21.83	22.00	18.72	18.81	18.98
		2	21.65	21.81	21.89	18.63	18.79	18.87
		3	21.63	21.84	21.86	18.61	18.82	18.84
		4	21.68	21.75	21.95	18.66	18.73	18.93
		5	21.58	21.79	21.93	18.56	18.77	18.91
	HSPA+	1	21.38	21.52	21.47	18.36	18.50	18.45

Note: ERP(dBm) = Conducted Power(dBm) + Antenna Gain(dBd)

For WCDMA Band5: Antenna Gain = -0.87dBi = -3.02dBd (0dBd=2.15dBi)

Limit: ERP ≤ 38.45dBm

PCS Band (Part 24E)

Mode	Test Mode	3GPP Sub Test	Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
WCDMA (Band 2)	RMC12.2k		24.20	24.27	23.94	22.95	23.02	22.69
	HSDPA	1	23.09	23.16	22.87	21.84	21.91	21.62
		2	23.02	23.12	22.85	21.77	21.87	21.60
		3	22.98	23.14	22.76	21.73	21.89	21.51
		4	22.95	23.16	22.77	21.70	21.91	21.52
	HSUPA	1	22.76	22.85	22.44	21.51	21.60	21.19
		2	22.76	22.82	22.52	21.51	21.57	21.27
		3	22.56	22.81	22.53	21.31	21.56	21.28
		4	22.54	22.86	22.48	21.29	21.61	21.23
		5	22.65	22.83	22.49	21.40	21.58	21.24
	HSPA+	1	22.18	22.56	22.34	20.93	21.31	21.09

Note: EIRP(dBm) = Conducted Power(dBm) + Antenna Gain(dBi)

For WCDMA Band2: Antenna Gain = -1.25dBi

Limit: EIRP ≤ 33dBm

LTE Band 2

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
1.4	QPSK	RB1#0	18.81	18.51	18.07	17.56	17.26	16.82
		RB1#3	18.84	18.54	18.19	17.59	17.29	16.94
		RB1#5	18.73	18.53	18.37	17.48	17.28	17.12
		RB3#0	18.91	18.58	18.30	17.66	17.33	17.05
		RB3#3	19.00	18.69	18.20	17.75	17.44	16.95
		RB6#0	17.83	17.67	17.23	16.58	16.42	15.98
	16QAM	RB1#0	18.08	17.64	17.37	16.83	16.39	16.12
		RB1#3	18.53	17.49	17.44	17.28	16.24	16.19
		RB1#5	18.39	17.35	17.26	17.14	16.10	16.01
		RB3#0	18.18	17.63	17.32	16.93	16.38	16.07
		RB3#3	18.19	17.58	17.29	16.94	16.33	16.04
		RB6#0	17.22	16.79	16.09	15.97	15.54	14.84
3.0	QPSK	RB1#0	18.90	18.57	18.20	17.65	17.32	16.95
		RB1#8	18.83	18.49	18.07	17.58	17.24	16.82
		RB1#14	18.78	18.52	18.06	17.53	17.27	16.81
		RB6#0	17.92	17.68	17.21	16.67	16.43	15.96
		RB6#9	17.90	17.52	17.09	16.65	16.27	15.84
		RB15#0	17.89	17.57	17.20	16.64	16.32	15.95
	16QAM	RB1#0	18.25	17.50	17.38	17.00	16.25	16.13
		RB1#8	18.32	17.13	17.27	17.07	15.88	16.02
		RB1#14	18.24	17.18	17.28	16.99	15.93	16.03
		RB6#0	17.08	16.44	16.20	15.83	15.19	14.95
		RB6#9	17.02	16.38	16.09	15.77	15.13	14.84
		RB15#0	16.92	16.63	16.39	15.67	15.38	15.14

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
5.0	QPSK	RB1#0	18.84	18.46	18.22	17.59	17.21	16.97
		RB1#13	18.68	18.63	18.25	17.43	17.38	17.00
		RB1#24	18.74	18.51	18.08	17.49	17.26	16.83
		RB15#0	17.84	17.72	17.17	16.59	16.47	15.92
		RB15#10	17.84	17.64	17.07	16.59	16.39	15.82
		RB25#0	17.82	17.65	17.13	16.57	16.40	15.88
	16QAM	RB1#0	18.09	17.42	16.84	16.84	16.17	15.59
		RB1#13	18.19	16.99	16.82	16.94	15.74	15.57
		RB1#24	18.06	16.99	16.51	16.81	15.74	15.26
		RB15#0	16.92	16.45	16.04	15.67	15.20	14.79
		RB15#10	16.80	16.68	16.02	15.55	15.43	14.77
		RB25#0	16.79	16.69	16.22	15.54	15.44	14.97
10.0	QPSK	RB1#0	19.00	18.81	18.24	17.75	17.56	16.99
		RB1#25	19.06	19.11	18.58	17.81	17.86	17.33
		RB1#49	18.79	18.44	18.14	17.54	17.19	16.89
		RB25#0	17.99	17.80	17.39	16.74	16.55	16.14
		RB25#25	17.96	17.69	17.17	16.71	16.44	15.92
		RB50#0	17.91	17.76	17.23	16.66	16.51	15.98
	16QAM	RB1#0	18.36	18.40	17.13	17.11	17.15	15.88
		RB1#25	18.76	18.32	17.84	17.51	17.07	16.59
		RB1#49	17.83	17.89	16.87	16.58	16.64	15.62
		RB25#0	16.97	16.95	16.27	15.72	15.70	15.02
		RB25#25	16.92	16.46	16.25	15.67	15.21	15.00
		RB50#0	16.92	16.84	16.55	15.67	15.59	15.30

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
15.0	QPSK	RB1#0	18.91	18.55	18.07	17.66	17.30	16.82
		RB1#38	18.81	18.66	18.31	17.56	17.41	17.06
		RB1#74	18.75	18.31	18.14	17.50	17.06	16.89
		RB36#0	17.70	17.82	17.15	16.45	16.57	15.90
		RB36#39	17.80	17.59	17.01	16.55	16.34	15.76
		RB75#0	17.81	17.68	17.20	16.56	16.43	15.95
	16QAM	RB1#0	18.28	17.50	17.52	17.03	16.25	16.27
		RB1#13	18.21	17.56	18.22	16.96	16.31	16.97
		RB1#26	18.26	16.77	17.33	17.01	15.52	16.08
		RB13#0	17.82	17.61	17.47	16.57	16.36	16.22
		RB13#14	17.90	16.93	17.15	16.65	15.68	15.90
		RB27#0	16.73	16.52	16.26	15.48	15.27	15.01
20.0	QPSK	RB1#0	18.91	18.40	18.07	17.66	17.15	16.82
		RB1#50	19.02	18.78	18.49	17.77	17.53	17.24
		RB1#99	18.56	18.18	17.94	17.31	16.93	16.69
		RB50#0	17.70	17.70	17.20	16.45	16.45	15.95
		RB50#50	17.70	17.46	17.16	16.45	16.21	15.91
		RB100#0	17.69	17.65	17.21	16.44	16.40	15.96
	16QAM	RB1#0	17.81	18.14	17.66	16.56	16.89	16.41
		RB1#13	17.63	18.52	17.82	16.38	17.27	16.57
		RB1#26	16.89	17.91	16.89	15.64	16.66	15.64
		RB13#0	17.63	17.60	17.04	16.38	16.35	15.79
		RB13#14	17.56	17.20	17.01	16.31	15.95	15.76
		RB27#0	16.60	16.78	16.18	15.35	15.53	14.93

Note: EIRP(dBm) = Conducted Power(dBm) + Antenna Gain(dBi)

For Band2: Antenna Gain = -1.25dBi

Limit: EIRP ≤ 33dBm

LTE Band 4

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
1.4	QPSK	RB1#0	20.66	20.39	20.78	19.80	19.53	19.92
		RB1#3	20.73	20.47	20.64	19.87	19.61	19.78
		RB1#5	20.69	20.42	20.65	19.83	19.56	19.79
		RB3#0	20.76	20.51	20.73	19.90	19.65	19.87
		RB3#3	20.76	20.44	20.47	19.90	19.58	19.61
		RB6#0	19.73	19.48	19.52	18.87	18.62	18.66
	16QAM	RB1#0	20.04	19.46	19.60	19.18	18.60	18.74
		RB1#3	20.18	19.65	19.79	19.32	18.79	18.93
		RB1#5	20.12	19.34	19.62	19.26	18.48	18.76
		RB3#0	19.75	19.65	19.73	18.89	18.79	18.87
		RB3#3	19.80	19.60	19.73	18.94	18.74	18.87
		RB6#0	18.80	18.53	18.67	17.94	17.67	17.81
3.0	QPSK	RB1#0	20.69	20.62	20.62	19.83	19.76	19.76
		RB1#8	20.72	20.62	20.61	19.86	19.76	19.75
		RB1#14	20.76	20.65	20.65	19.90	19.79	19.79
		RB6#0	19.81	19.72	19.73	18.95	18.86	18.87
		RB6#9	19.93	19.65	19.70	19.07	18.79	18.84
		RB15#0	19.96	19.73	19.66	19.10	18.87	18.80
	16QAM	RB1#0	19.54	19.92	20.08	18.68	19.06	19.22
		RB1#8	19.48	19.88	20.11	18.62	19.02	19.25
		RB1#14	19.54	19.71	20.48	18.68	18.85	19.62
		RB6#0	18.75	18.63	18.83	17.89	17.77	17.97
		RB6#9	18.80	18.57	18.72	17.94	17.71	17.86
		RB15#0	18.97	18.65	18.57	18.11	17.79	17.71

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
5.0	QPSK	RB1#0	20.81	20.46	20.71	19.95	19.60	19.85
		RB1#13	21.08	20.62	20.64	20.22	19.76	19.78
		RB1#24	20.92	20.73	20.67	20.06	19.87	19.81
		RB15#0	19.93	19.83	19.74	19.07	18.97	18.88
		RB15#10	19.92	19.75	19.81	19.06	18.89	18.95
		RB25#0	19.95	19.68	19.82	19.09	18.82	18.96
	16QAM	RB1#0	19.84	19.33	19.98	18.98	18.47	19.12
		RB1#13	19.92	19.11	20.02	19.06	18.25	19.16
		RB1#24	19.89	18.98	20.03	19.03	18.12	19.17
		RB15#0	18.83	18.53	18.60	17.97	17.67	17.74
		RB15#10	18.85	18.56	18.60	17.99	17.70	17.74
		RB25#0	18.90	18.78	18.65	18.04	17.92	17.79
10.0	QPSK	RB1#0	20.72	20.67	20.41	19.86	19.81	19.55
		RB1#25	21.18	20.77	20.94	20.32	19.91	20.08
		RB1#49	20.67	20.66	20.87	19.81	19.80	20.01
		RB25#0	19.89	19.68	19.47	19.03	18.82	18.61
		RB25#25	19.81	19.58	19.72	18.95	18.72	18.86
		RB50#0	19.81	19.64	19.71	18.95	18.78	18.85
	16QAM	RB1#0	20.05	20.31	19.30	19.19	19.45	18.44
		RB1#25	20.66	20.74	19.49	19.80	19.88	18.63
		RB1#49	19.87	20.20	19.24	19.01	19.34	18.38
		RB25#0	18.76	18.93	18.59	17.90	18.07	17.73
		RB25#25	18.80	18.76	18.94	17.94	17.90	18.08
		RB50#0	18.80	18.76	18.54	17.94	17.90	17.68

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
15.0	QPSK	RB1#0	20.82	20.63	20.57	19.96	19.77	19.71
		RB1#38	20.84	20.70	20.40	19.98	19.84	19.54
		RB1#74	20.64	20.36	20.49	19.78	19.50	19.63
		RB36#0	19.84	19.73	19.59	18.98	18.87	18.73
		RB36#39	19.69	19.55	19.64	18.83	18.69	18.78
		RB75#0	19.74	19.59	19.48	18.88	18.73	18.62
	16QAM	RB1#0	20.23	20.29	19.86	19.37	19.43	19.00
		RB1#13	20.13	20.65	19.45	19.27	19.79	18.59
		RB1#26	19.91	19.93	18.79	19.05	19.07	17.93
		RB13#0	20.09	19.97	19.54	19.23	19.11	18.68
		RB13#14	19.85	19.83	19.55	18.99	18.97	18.69
		RB27#0	18.69	18.82	18.52	17.83	17.96	17.66
20.0	QPSK	RB1#0	20.55	20.49	20.64	19.69	19.63	19.78
		RB1#50	20.94	20.87	20.62	20.08	20.01	19.76
		RB1#99	20.49	20.55	20.48	19.63	19.69	19.62
		RB50#0	19.83	19.68	19.76	18.97	18.82	18.90
		RB50#50	19.84	19.49	19.71	18.98	18.63	18.85
		RB100#0	19.89	19.54	19.59	19.03	18.68	18.73
	16QAM	RB1#0	20.06	19.76	20.43	19.20	18.90	19.57
		RB1#13	20.51	19.67	20.54	19.65	18.81	19.68
		RB1#26	20.13	19.05	20.36	19.27	18.19	19.50
		RB13#0	19.71	19.30	19.73	18.85	18.44	18.87
		RB13#14	19.80	19.22	19.67	18.94	18.36	18.81
		RB27#0	18.76	18.62	18.68	17.90	17.76	17.82

Note: EIRP(dBm) = Conducted Power(dBm) + Antenna Gain(dBi)

For Band4: Antenna Gain = -0.86dBi

Limit: EIRP ≤ 33dBm

LTE Band 12

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			ERP(dBm)		
			Low	Mid	High	Low	Mid	High
1.4	QPSK	RB1#0	22.18	22.12	22.52	19.31	19.25	19.65
		RB1#3	22.40	22.14	22.60	19.53	19.27	19.73
		RB1#5	22.35	22.13	22.47	19.48	19.26	19.60
		RB3#0	22.12	22.39	22.35	19.25	19.52	19.48
		RB3#3	22.41	22.34	22.39	19.54	19.47	19.52
		RB6#0	21.35	21.38	21.38	18.48	18.51	18.51
	16QAM	RB1#0	21.68	21.12	21.69	18.81	18.25	18.82
		RB1#3	21.86	21.18	21.58	18.99	18.31	18.71
		RB1#5	21.78	21.07	21.44	18.91	18.20	18.57
		RB3#0	21.27	21.37	21.52	18.40	18.50	18.65
		RB3#3	21.43	21.37	21.19	18.56	18.50	18.32
		RB6#0	20.20	20.52	20.44	17.33	17.65	17.57
3.0	QPSK	RB1#0	22.39	22.33	22.31	19.52	19.46	19.44
		RB1#8	22.51	22.25	22.57	19.64	19.38	19.70
		RB1#14	22.19	22.03	22.27	19.32	19.16	19.40
		RB6#0	21.40	21.35	21.40	18.53	18.48	18.53
		RB6#9	21.46	21.26	21.40	18.59	18.39	18.53
		RB15#0	21.48	21.33	21.45	18.61	18.46	18.58
	16QAM	RB1#0	21.74	21.82	21.36	18.87	18.95	18.49
		RB1#8	22.18	21.75	21.28	19.31	18.88	18.41
		RB1#14	21.58	21.79	21.49	18.71	18.92	18.62
		RB6#0	20.36	20.53	20.66	17.49	17.66	17.79
		RB6#9	20.52	20.30	20.76	17.65	17.43	17.89
		RB15#0	20.42	20.28	20.60	17.55	17.41	17.73

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			ERP(dBm)		
			Low	Mid	High	Low	Mid	High
5.0	QPSK	RB1#0	22.19	22.31	22.11	19.32	19.44	19.24
		RB1#13	22.38	22.35	22.35	19.51	19.48	19.48
		RB1#24	22.15	22.05	22.14	19.28	19.18	19.27
		RB15#0	21.35	21.26	21.34	18.48	18.39	18.47
		RB15#10	21.39	21.25	21.35	18.52	18.38	18.48
		RB25#0	21.31	21.24	21.38	18.44	18.37	18.51
	16QAM	RB1#0	21.06	20.97	21.38	18.19	18.10	18.51
		RB1#13	21.33	20.93	21.81	18.46	18.06	18.94
		RB1#24	21.13	20.61	21.69	18.26	17.74	18.82
		RB15#0	20.25	20.22	20.21	17.38	17.35	17.34
		RB15#10	20.25	20.13	20.43	17.38	17.26	17.56
		RB25#0	20.33	20.29	20.29	17.46	17.42	17.42
10.0	QPSK	RB1#0	22.24	21.96	22.12	19.37	19.09	19.25
		RB1#25	22.32	22.19	22.36	19.45	19.32	19.49
		RB1#49	21.88	22.05	22.12	19.01	19.18	19.25
		RB25#0	21.24	21.41	21.39	18.37	18.54	18.52
		RB25#25	21.29	21.25	21.51	18.42	18.38	18.64
		RB50#0	21.43	21.41	21.31	18.56	18.54	18.44
	16QAM	RB1#0	21.94	21.03	21.68	19.07	18.16	18.81
		RB1#13	22.42	21.01	22.22	19.55	18.14	19.35
		RB1#26	21.83	20.60	22.16	18.96	17.73	19.29
		RB13#0	20.19	20.20	20.33	17.32	17.33	17.46
		RB13#14	20.11	20.38	20.54	17.24	17.51	17.67
		RB27#0	20.34	20.46	20.43	17.47	17.59	17.56

Note: ERP(dBm) = Conducted Power(dBm) + Antenna Gain(dBd)
 For Band12: Antenna Gain = -0.72dBi = -2.87dBd (0dBd=2.15dBi)
 Limit: ERP ≤ 34.77dBm

Peak-to-average ratio (PAR)**WCDMA Band 5**

Mode	Channel	PAR (dB)	Limit (dB)
RMC (BPSK)	Low	3.10	13
	Middle	3.13	13
	High	3.07	13
HSDPA (16QAM)	Low	3.77	13
	Middle	3.80	13
	High	3.68	13
HSUPA (QPSK)	Low	3.68	13
	Middle	3.88	13
	High	3.65	13
HSPA+	Low	3.64	13
	Middle	3.54	13
	High	3.69	13

WCDMA Band 2

Mode	Channel	PAR (dB)	Limit (dB)
RMC (BPSK)	Low	3.13	13
	Middle	3.10	13
	High	3.07	13
HSDPA (16QAM)	Low	3.80	13
	Middle	3.80	13
	High	3.77	13
HSUPA (QPSK)	Low	3.65	13
	Middle	3.62	13
	High	3.59	13
HSPA+	Low	3.64	13
	Middle	3.61	13
	High	3.58	13

LTE Band 2 20MHz Bandwidth

Modulation	Low channel (dB)	Middle channel (dB)	High channel (dB)	PAR Limit (dB)	Result
QPSK (1RB Size)	4.41	4.29	4.35	13	Pass
QPSK (100RB Size)	4.72	4.75	4.67	13	Pass
16QAM (1RB Size)	5.48	5.28	5.54	13	Pass
16QAM (27RB Size)	5.65	5.65	5.54	13	Pass

LTE Band 4 20MHz Bandwidth

Modulation	Low channel (dB)	Middle channel (dB)	High channel (dB)	PAR Limit (dB)	Result
QPSK (1RB Size)	4.46	4.52	4.41	13	Pass
QPSK (100RB Size)	4.78	4.70	4.64	13	Pass
16QAM (1RB Size)	5.57	5.25	5.33	13	Pass
16QAM (27RB Size)	5.65	5.62	5.65	13	Pass

LTE Band 12 10MHz Bandwidth

Modulation	Low channel (dB)	Middle channel (dB)	High channel (dB)	PAR Limit (dB)	Result
QPSK (1RB Size)	4.32	4.41	4.43	13	Pass
QPSK (50RB Size)	4.55	4.84	5.07	13	Pass
16QAM (1RB Size)	5.36	5.42	5.10	13	Pass
16QAM (27RB Size)	5.77	5.71	5.62	13	Pass

FCC §2.1049, §22.917, §22.905 & §24.238& §27.53 - OCCUPIED BANDWIDTH

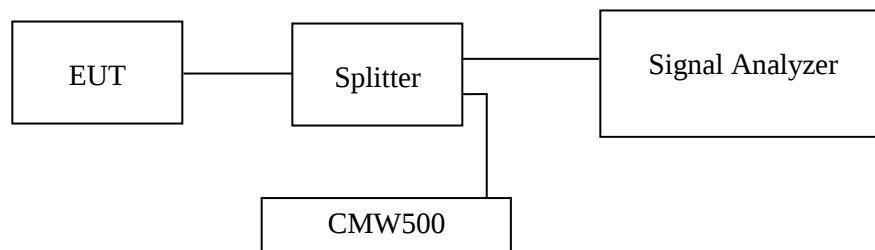
Applicable Standard

FCC 47 §2.1049, §22.917, §22.905, §24.238, §27.53.

Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 1% to 5% of the anticipated emission bandwidth and the 26 dB & 99% bandwidth was recorded.



Note: the worst path loss (cable loss and splitter inset loss) among the test frequency range has included in plot.

Test Data

Environmental Conditions

Temperature:	24~27 °C
Relative Humidity:	52~60 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang from 2023-05-15 to 2023-05-19.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the following tables and plots.

Cellular Band (Part 22H)

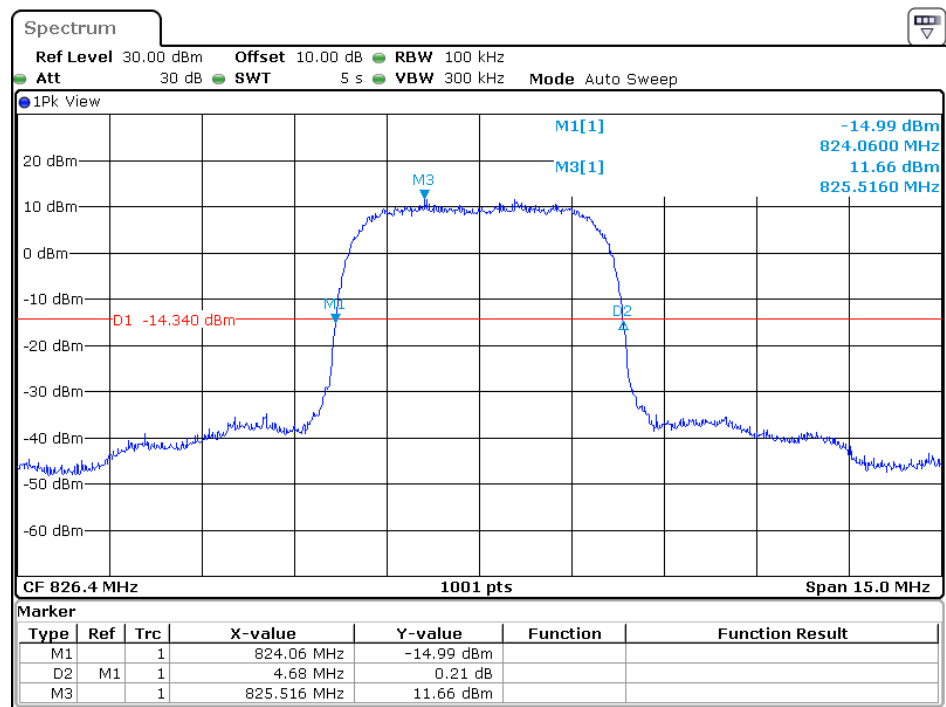
Frequency (MHz)		Occupied Bandwidth (MHz)	26dB Bandwidth (MHz)
RMC	826.4	4.136	4.680
	836.6	4.151	4.695
	846.6	4.136	4.710
HSDPA	826.4	4.151	4.680
	836.6	4.151	4.695
	846.6	4.136	4.710
HSUPA	826.4	4.136	4.695
	836.6	4.151	4.695
	846.6	4.151	4.695

PCS Band (Part 24E)

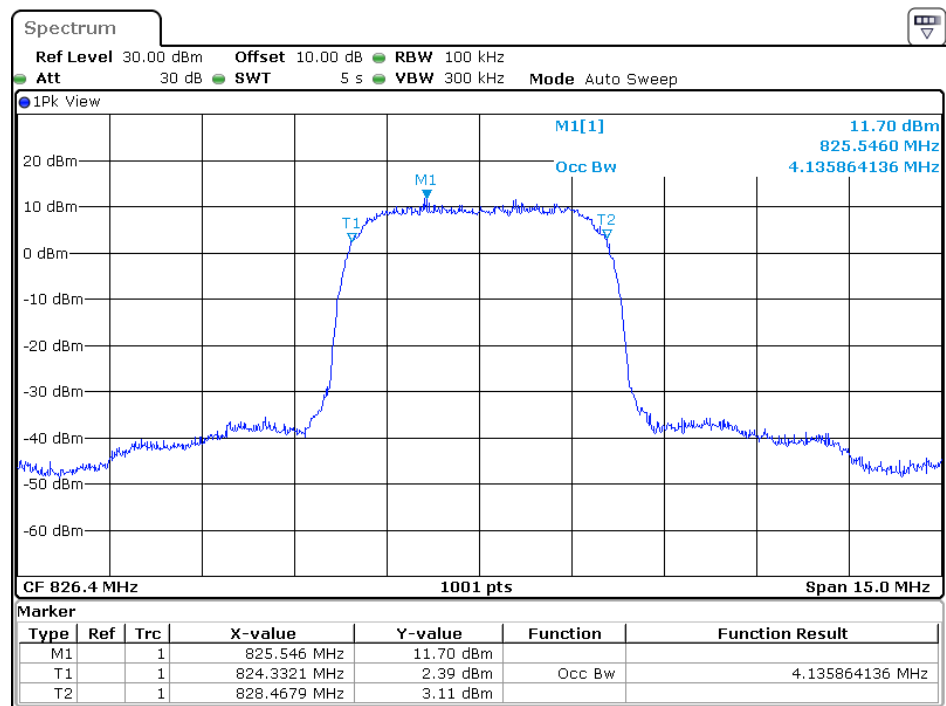
Frequency (MHz)		Occupied Bandwidth (MHz)	26dB Bandwidth (MHz)
RMC	1852.4	4.136	4.695
	1880.0	4.136	4.695
	1907.6	4.136	4.695
HSDPA	1852.4	4.151	4.710
	1880.0	4.151	4.695
	1907.6	4.136	4.680
HSUPA	1852.4	4.151	4.710
	1880.0	4.151	4.695
	1907.6	4.136	4.695

Cellular Band (Part 22H)

26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode, Low channel

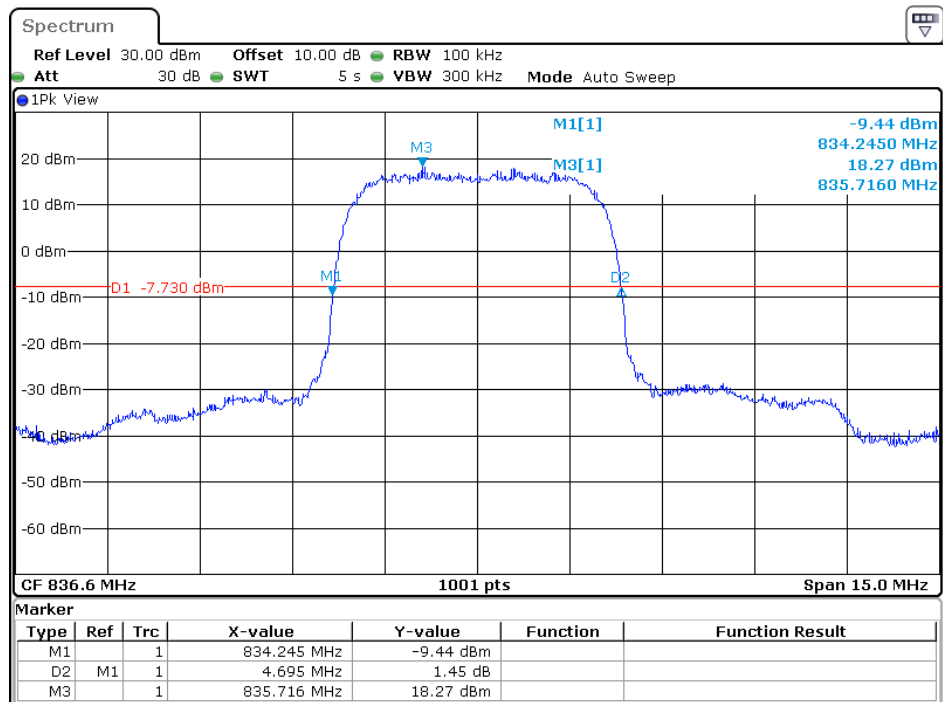


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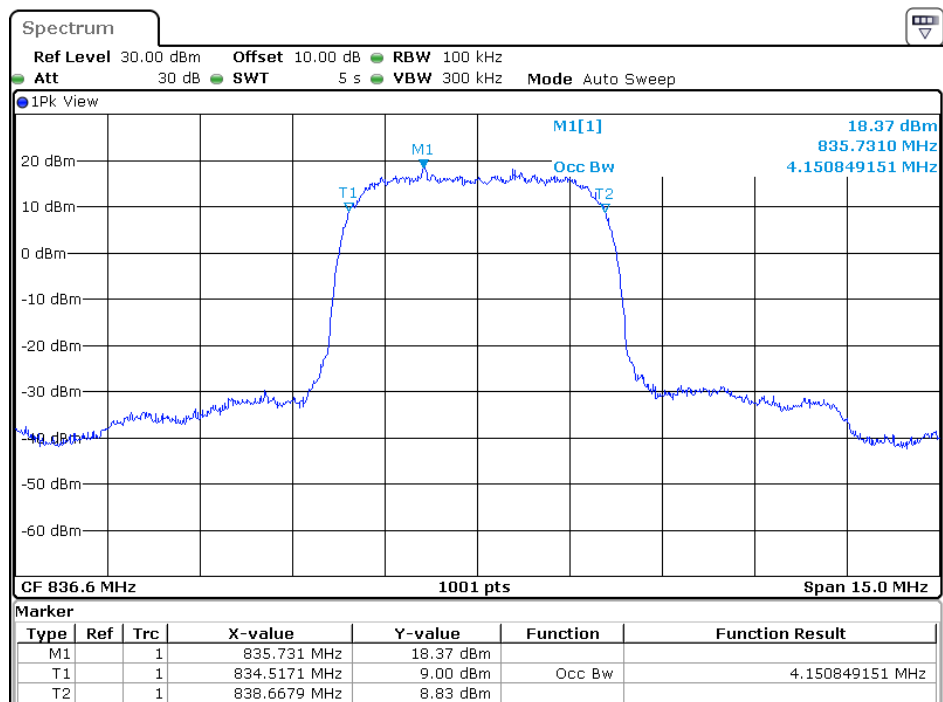


Date: 19.MAY.2023 14:10:17

26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode, Middle channel

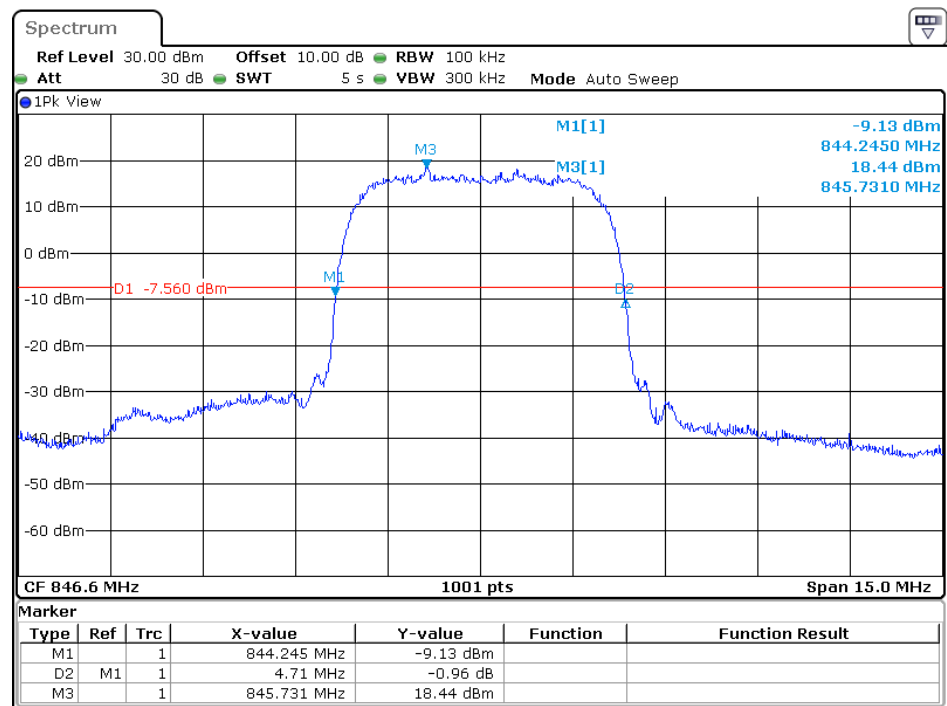


Date: 19.MAY.2023 11:15:16

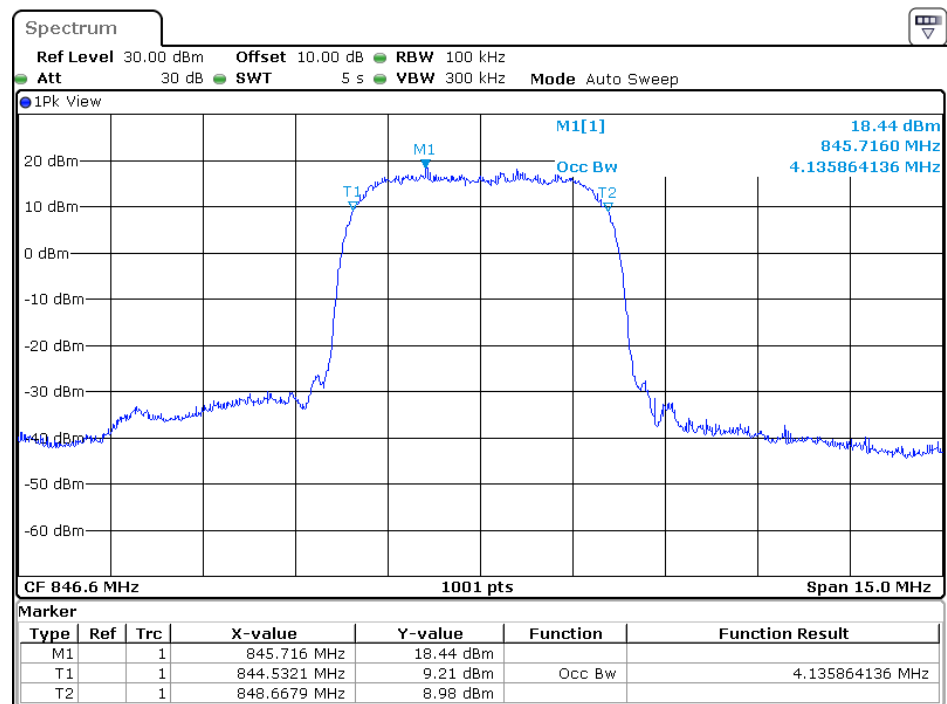


Date: 19.MAY.2023 11:14:49

26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode, High channel

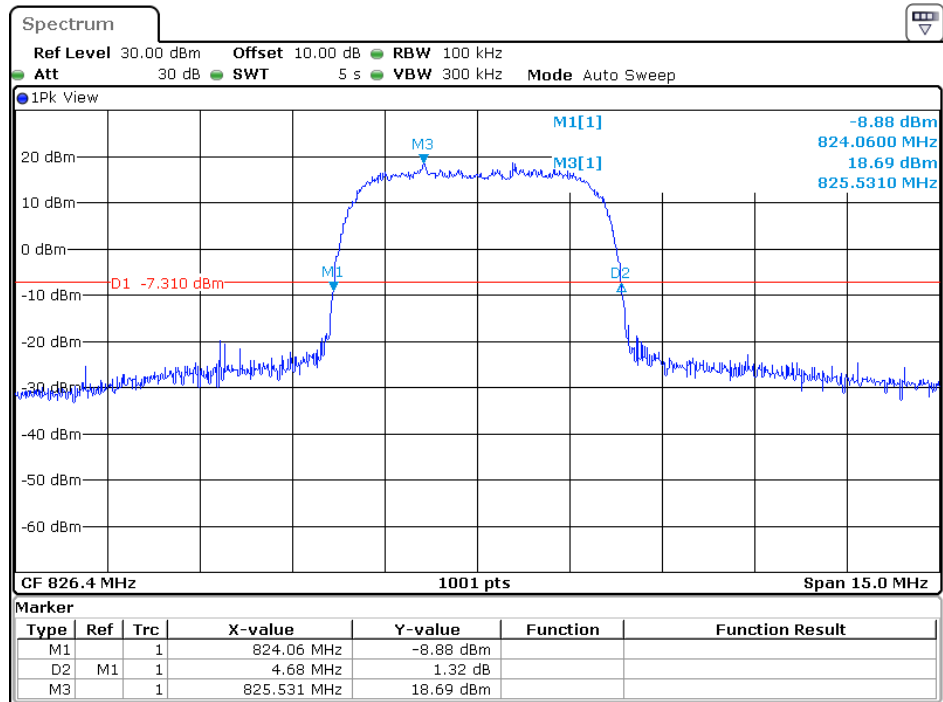


Date: 19.MAY.2023 11:18:31

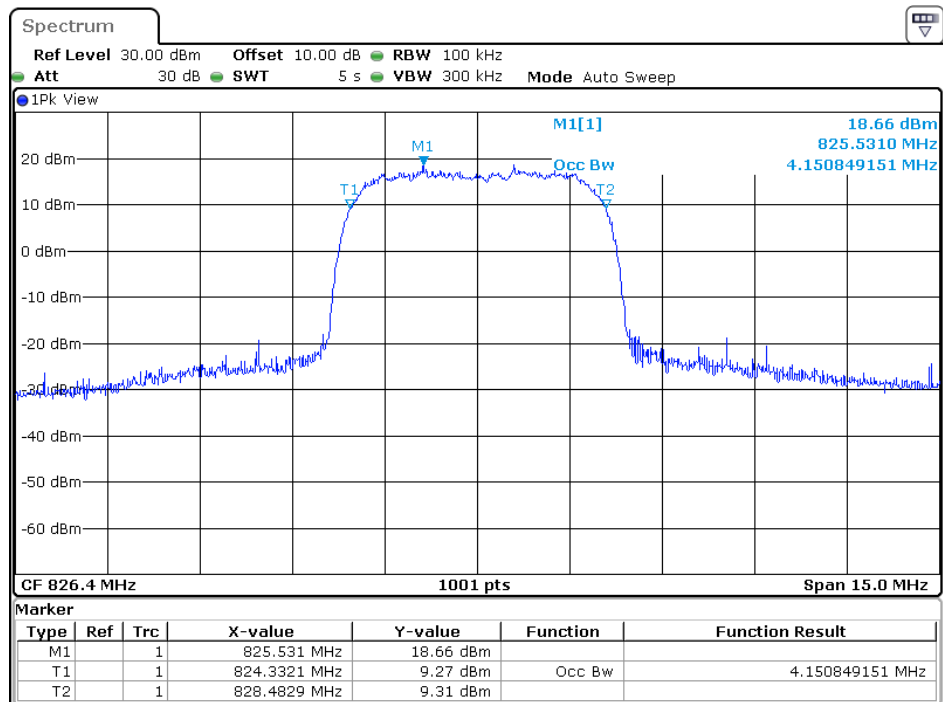


Date: 19.MAY.2023 11:18:04

26 dB Emissions & 99% Occupied Bandwidth for HSDPA (QPSK) Mode, Low channel

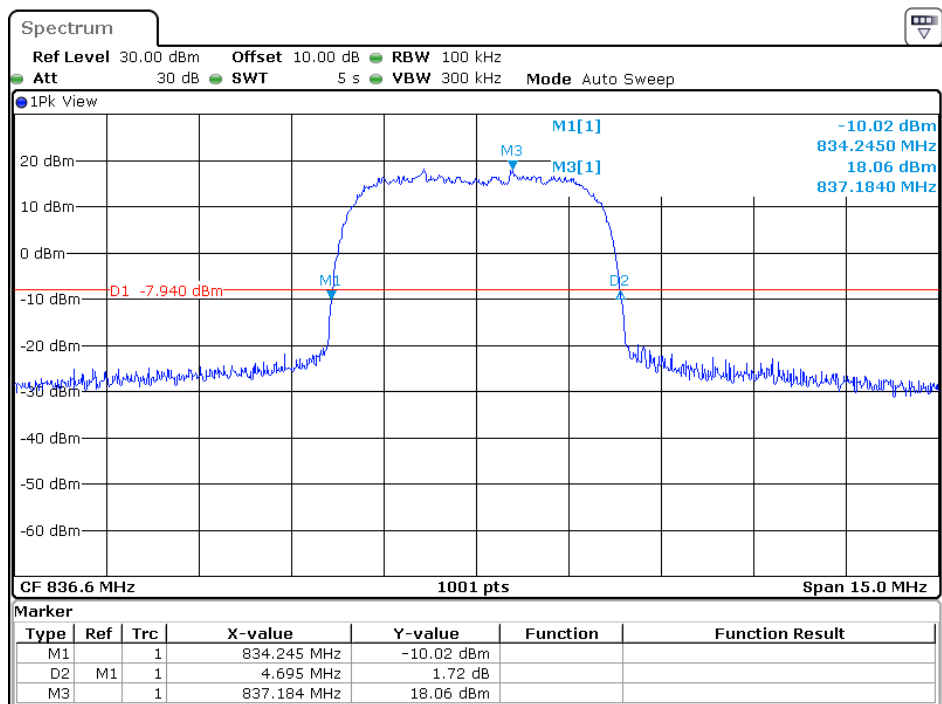


Date: 19.MAY.2023 14:17:38

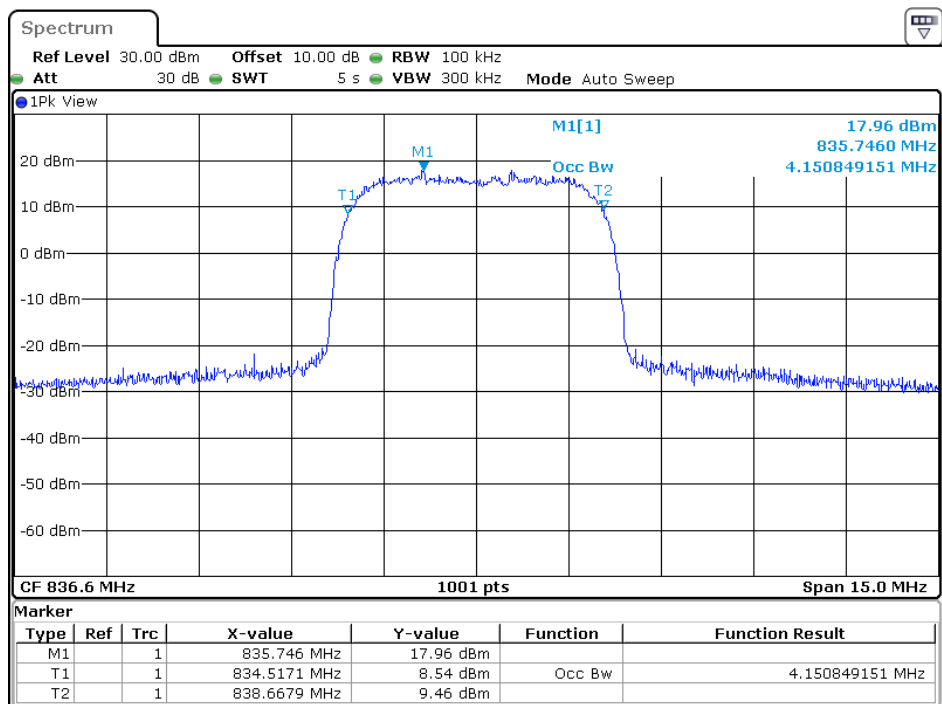


Date: 19.MAY.2023 14:16:56

26 dB Emissions & 99% Occupied Bandwidth for HSDPA (QPSK) Mode, Middle channel

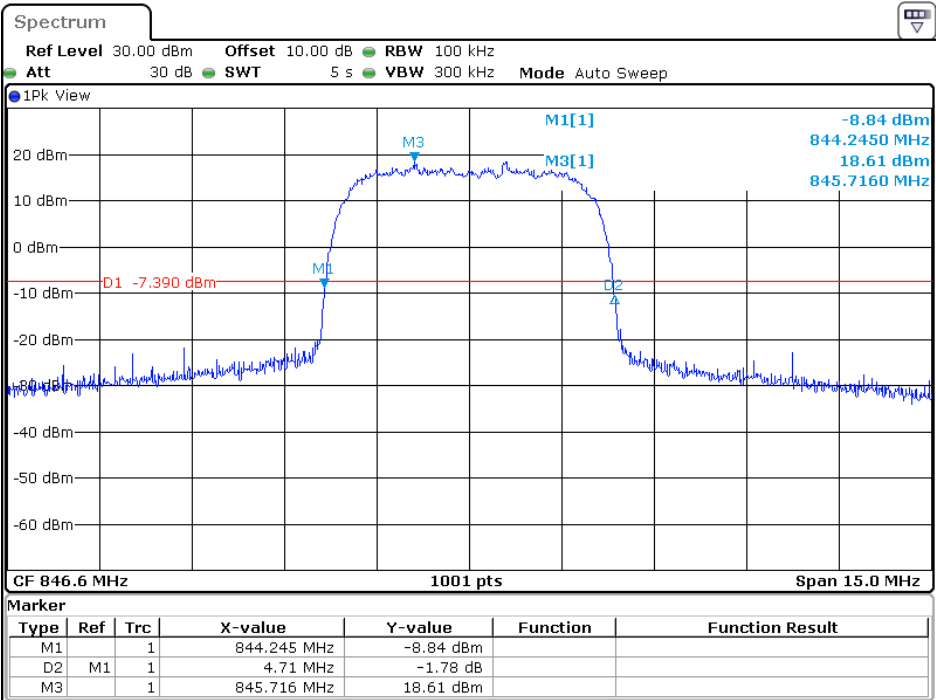


Date: 19.MAY.2023 11:29:08

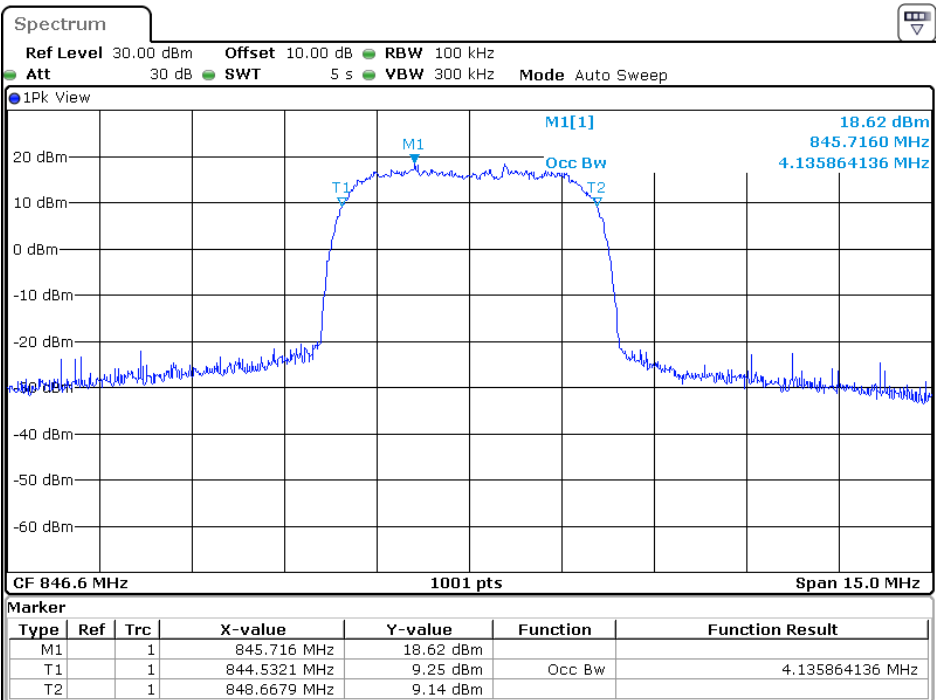


Date: 19.MAY.2023 11:27:55

26 dB Emissions & 99% Occupied Bandwidth for HSDPA (QPSK) Mode, High channel

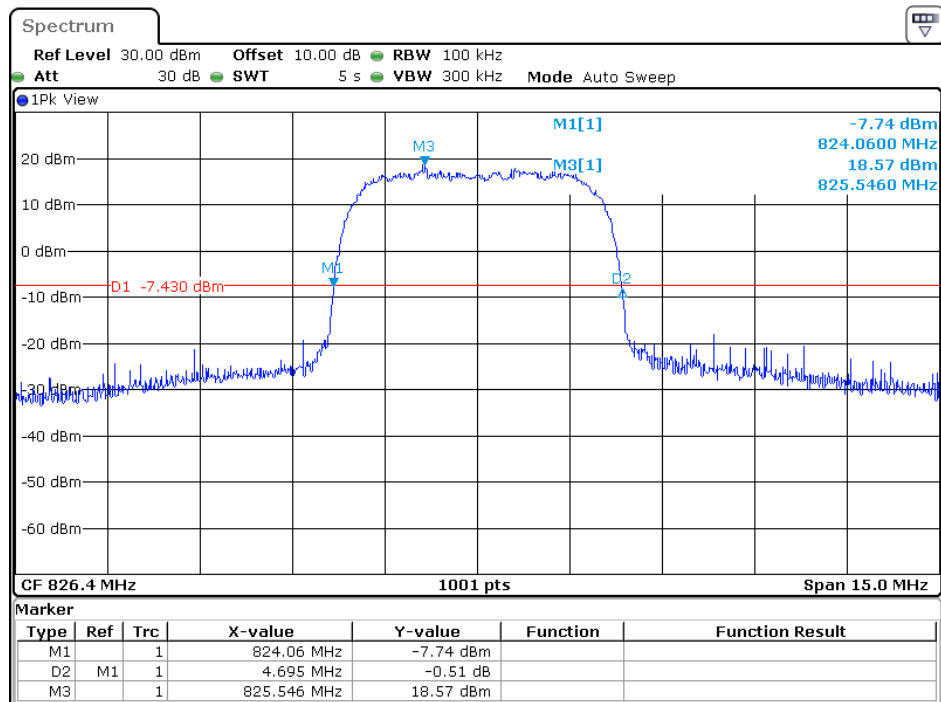


Date: 19.MAY.2023 11:34:03

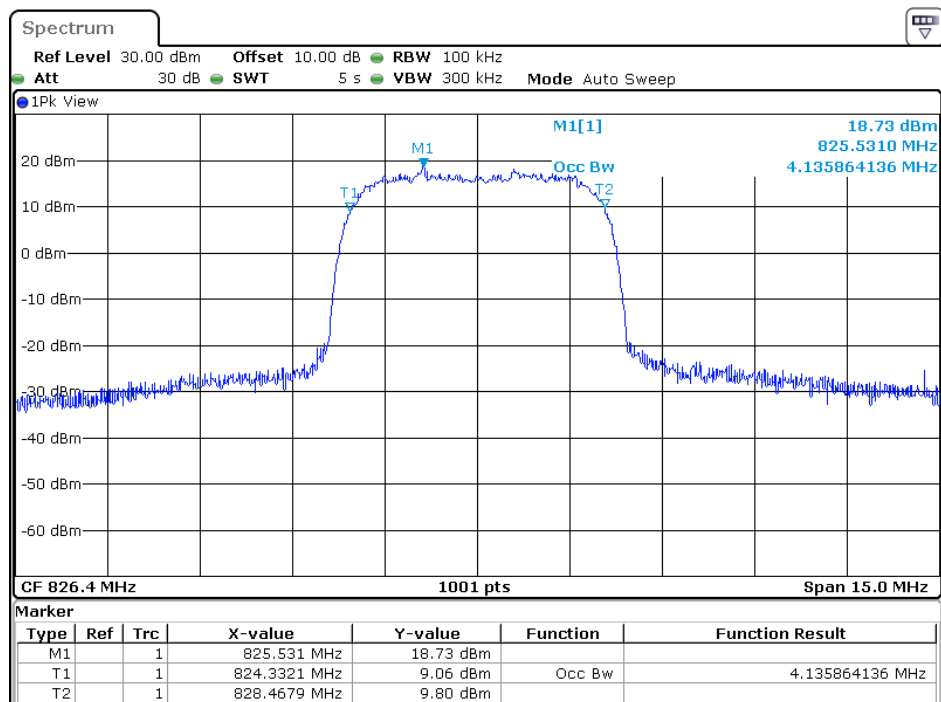


Date: 19.MAY.2023 11:33:05

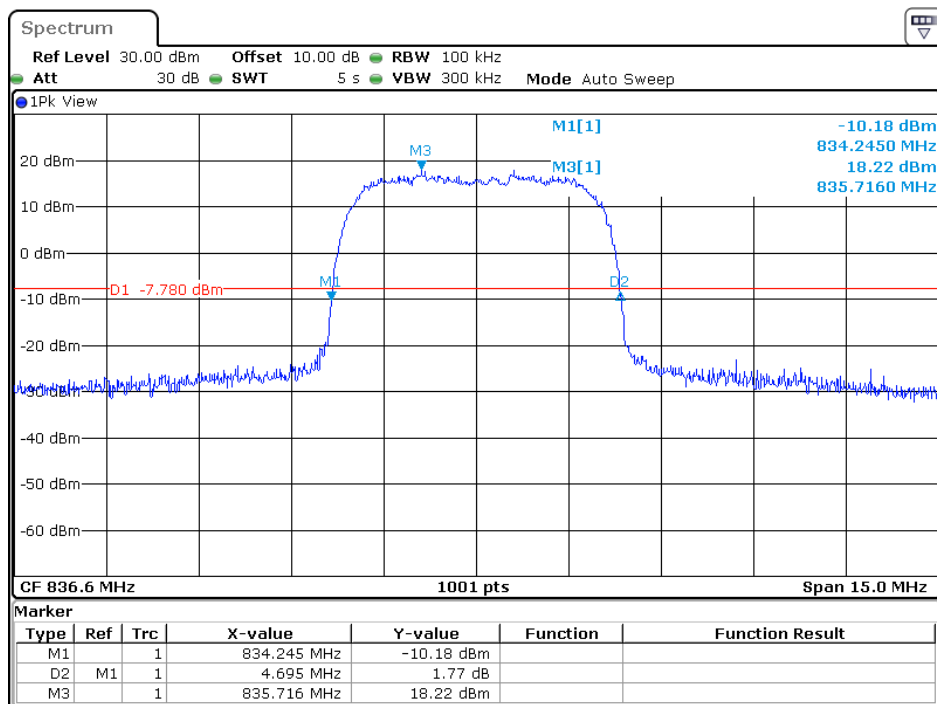
26 dB Emissions & 99% Occupied Bandwidth for HSUPA (16QAM) Mode, Low channel



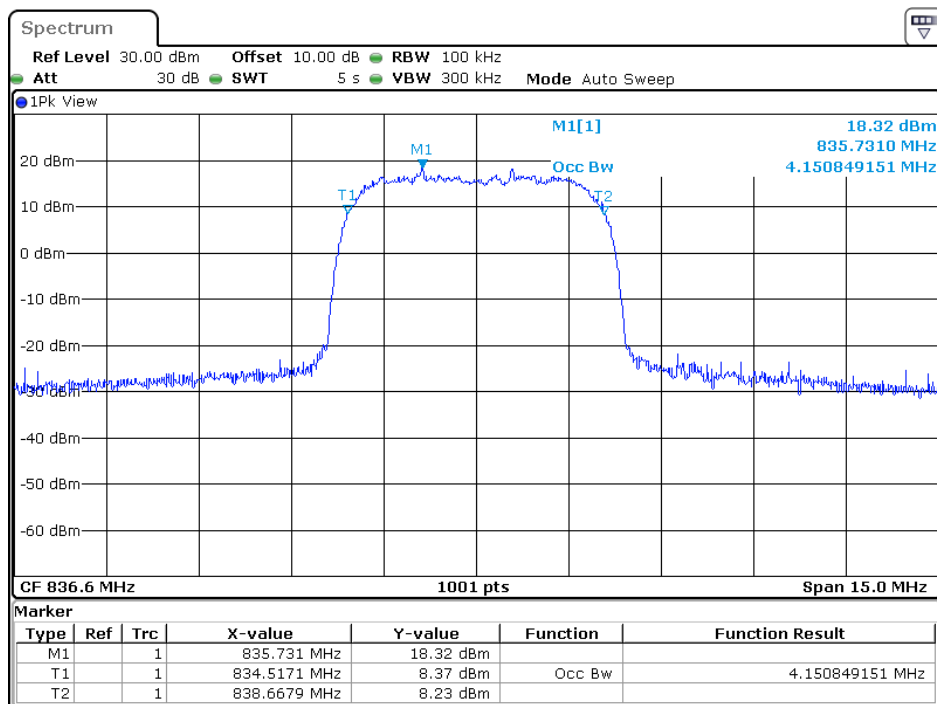
Date: 19.MAY.2023 14:23:16



Date: 19.MAY.2023 14:21:03

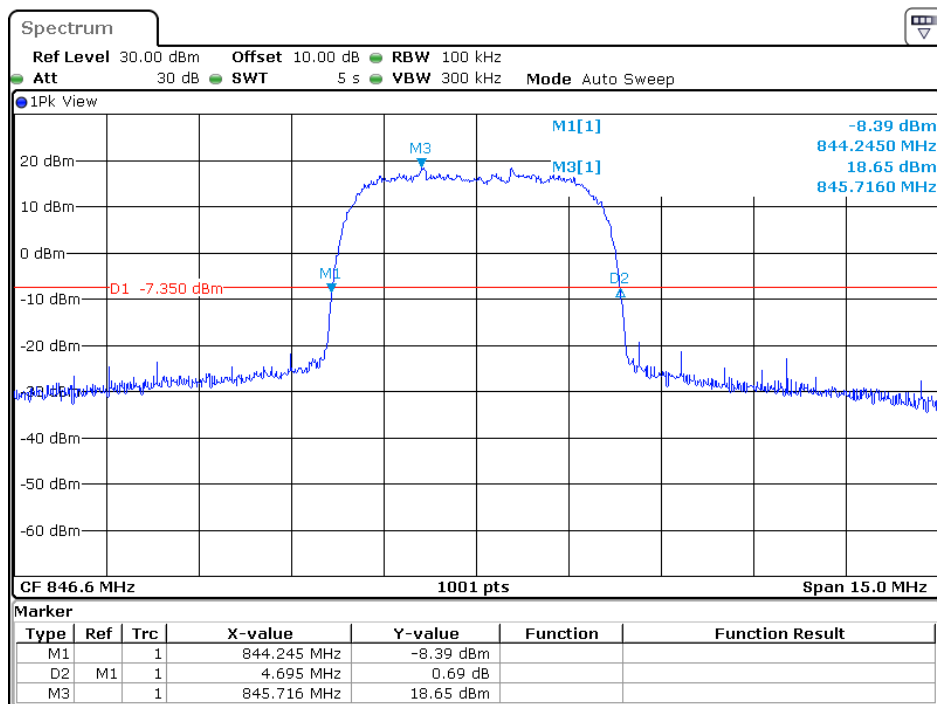
26 dB Emissions & 99% Occupied Bandwidth for HSUPA (16QAM) Mode, Middle channel

Date: 19.MAY.2023 11:46:12

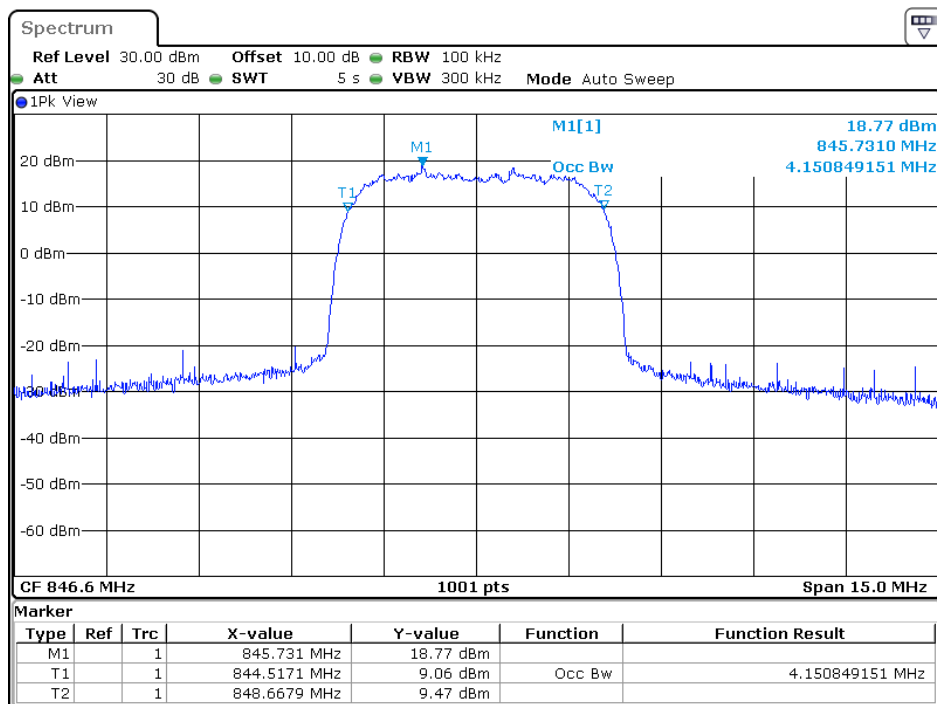


Date: 19.MAY.2023 11:45:30

26 dB Emissions & 99% Occupied Bandwidth for HSUPA (16QAM) Mode, High channel



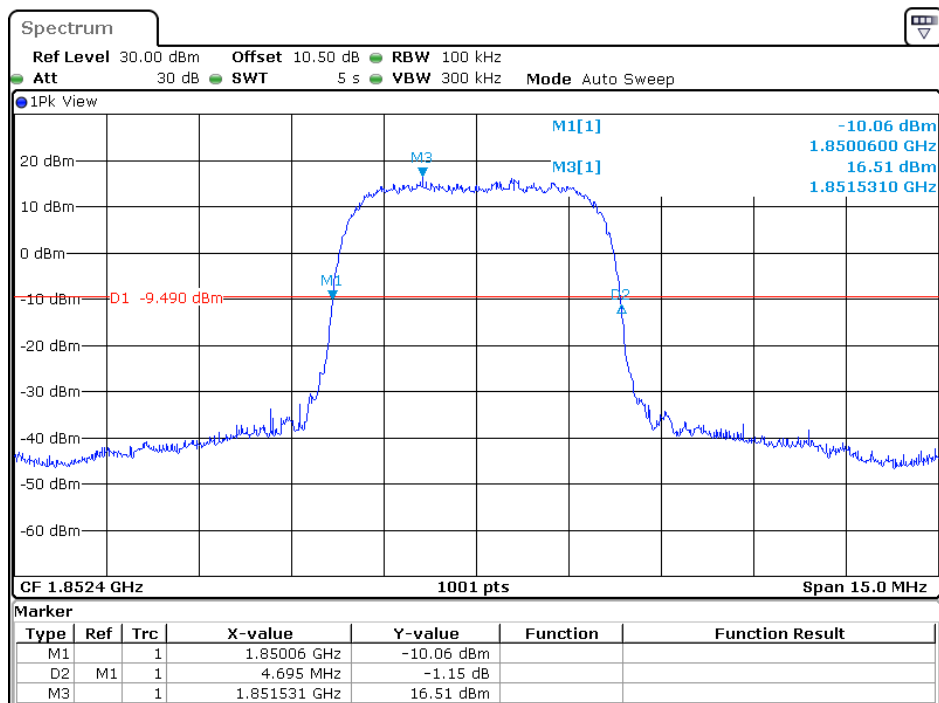
Date: 19.MAY.2023 11:54:51



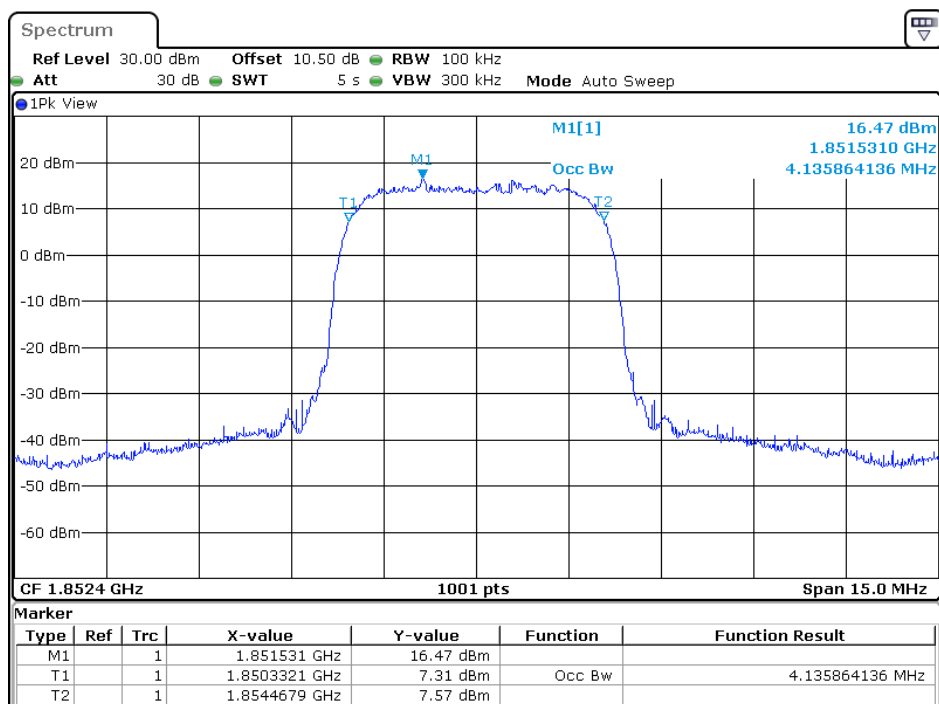
Date: 19.MAY.2023 11:53:38

PCS Band (Part 24E)

26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode, Low channel

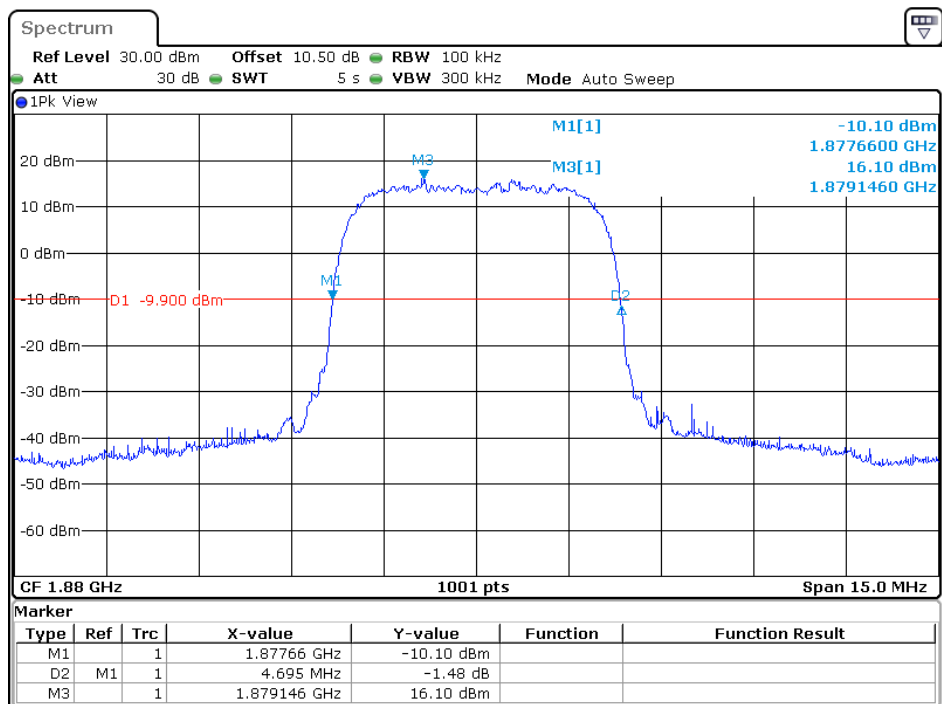


Date: 19.MAY.2023 09:58:44

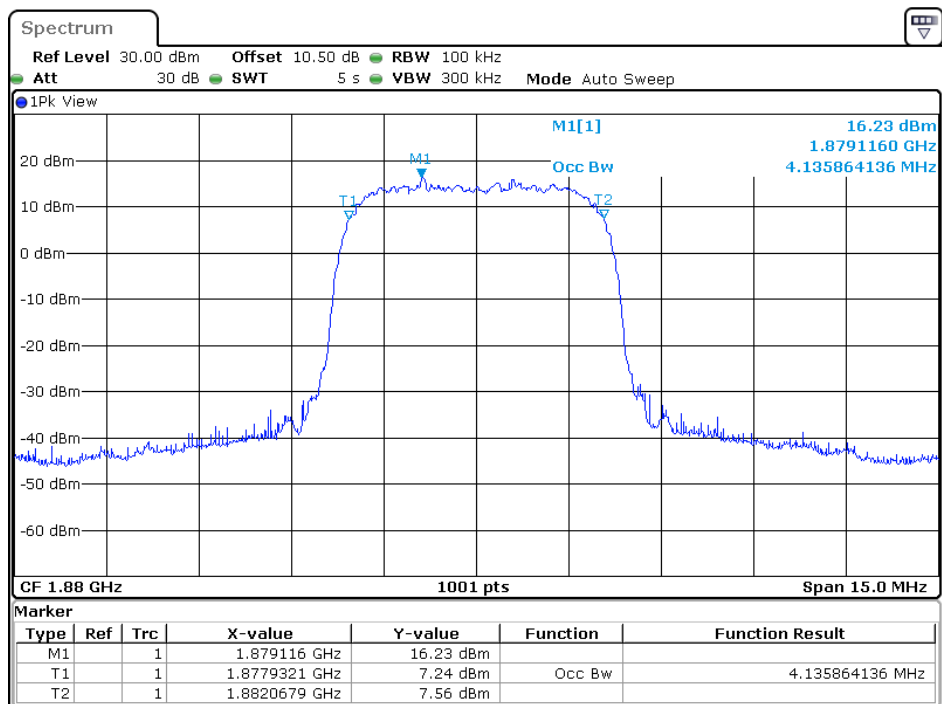


Date: 19.MAY.2023 09:58:17

26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode, Middle channel

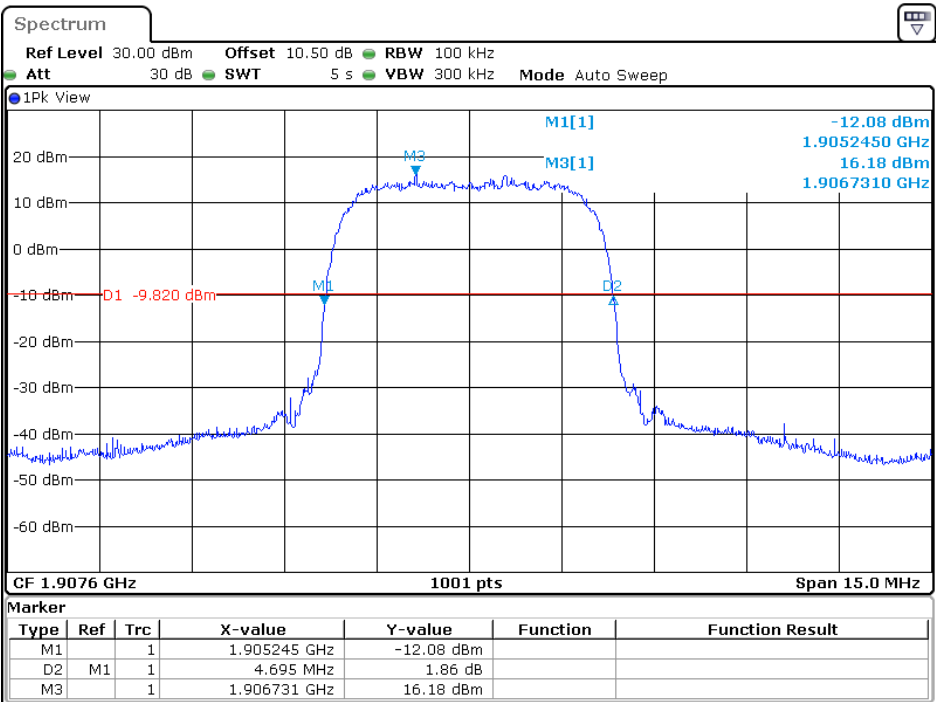


Date: 19.MAY.2023 10:03:45

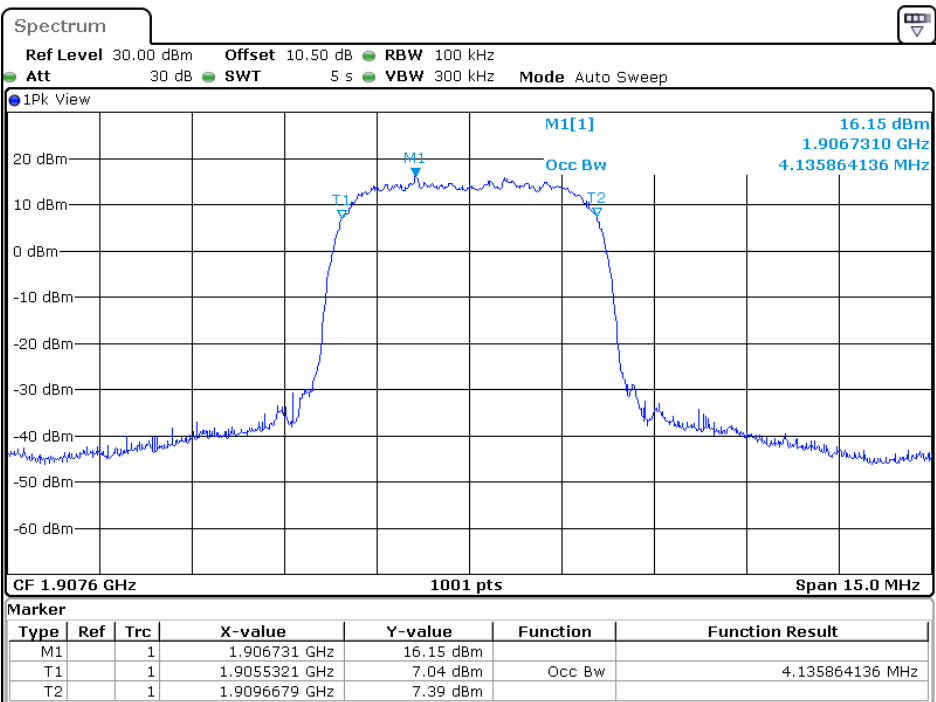


Date: 19.MAY.2023 10:03:02

26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode, High channel

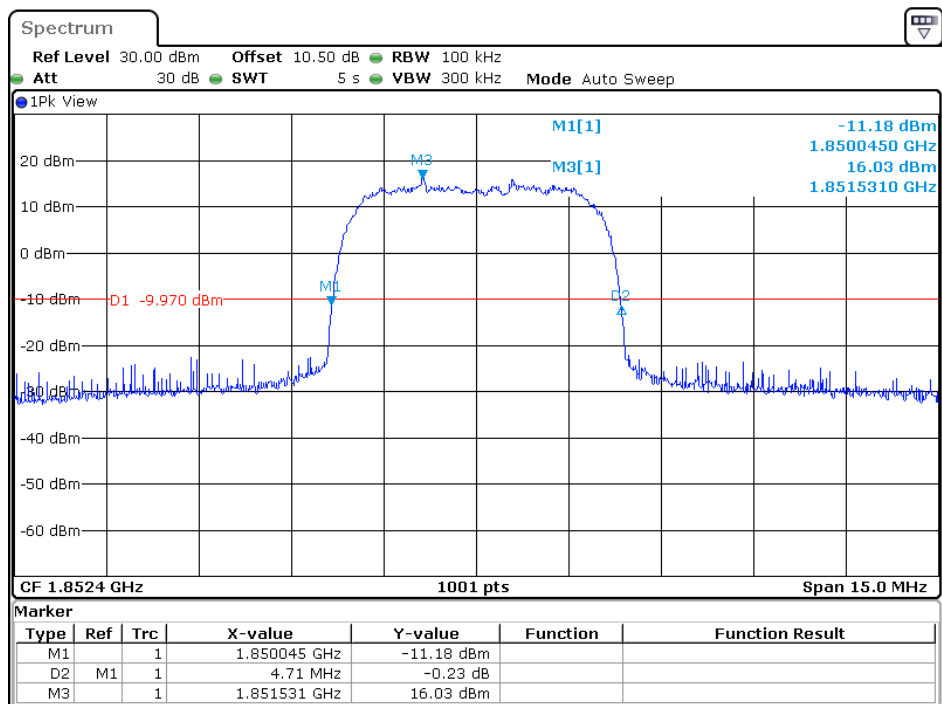


Date: 19.MAY.2023 10:07:37

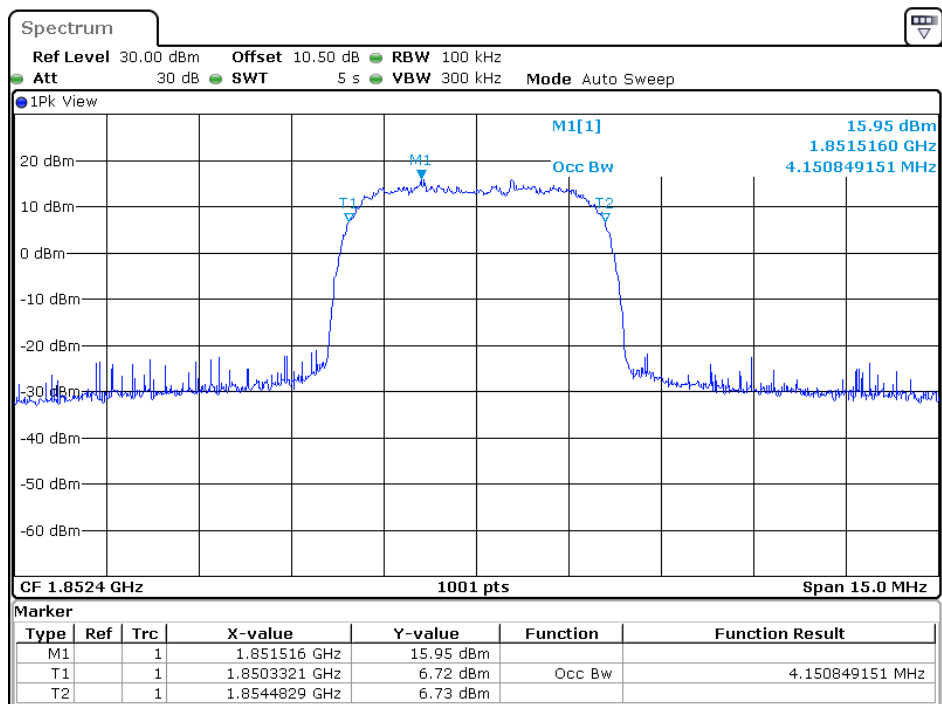


Date: 19.MAY.2023 10:07:10

26 dB Emissions & 99% Occupied Bandwidth for HSDPA (QPSK) Mode, Low channel

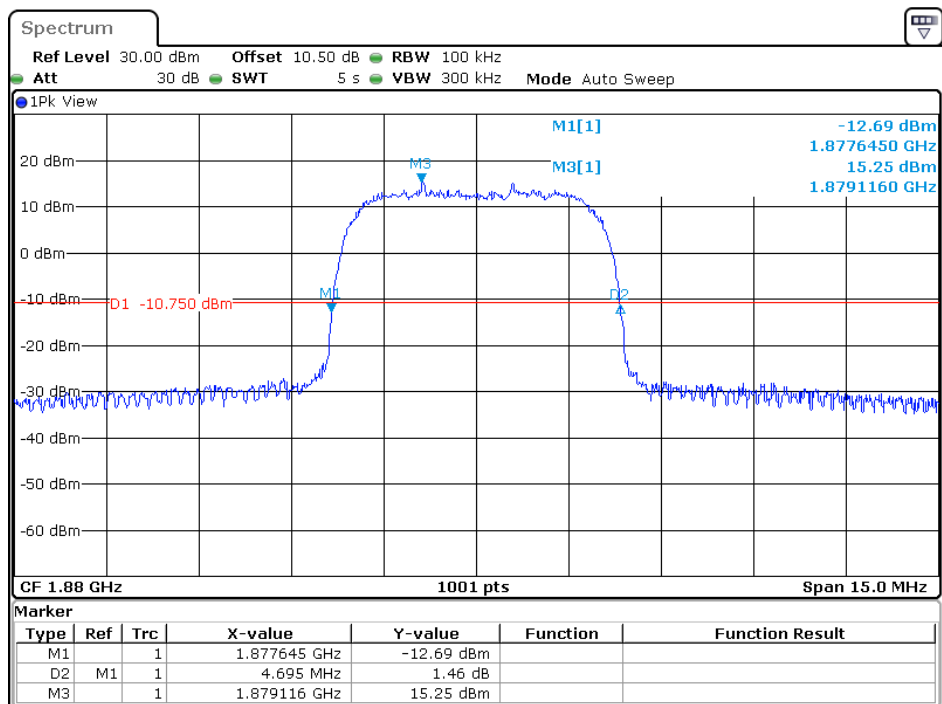


Date: 19.MAY.2023 10:18:28

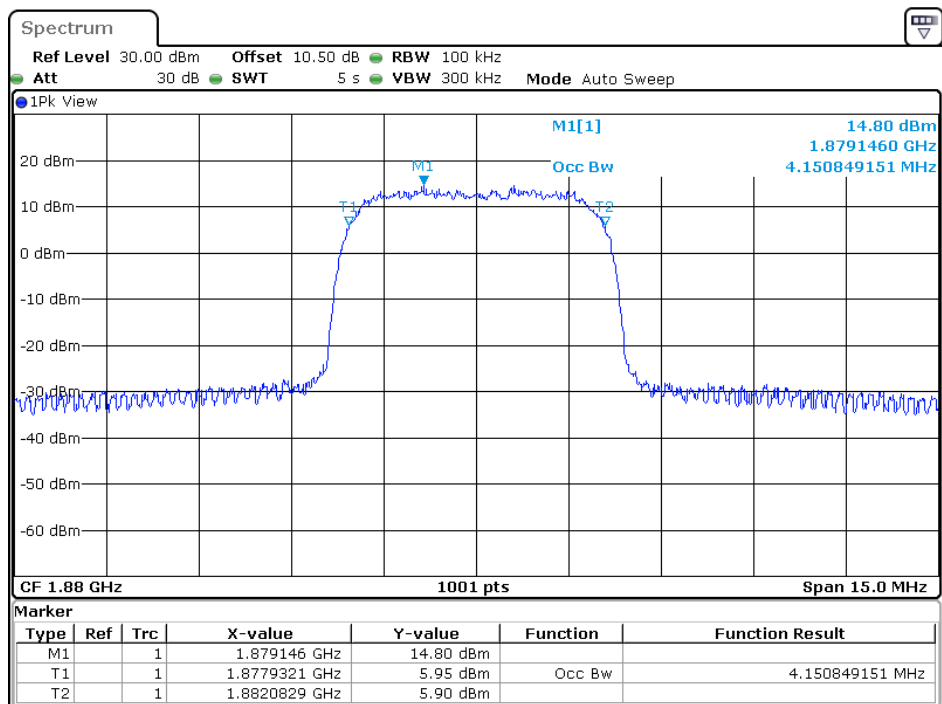


Date: 19.MAY.2023 10:17:00

26 dB Emissions & 99% Occupied Bandwidth for HSDPA (QPSK) Mode, Middle channel

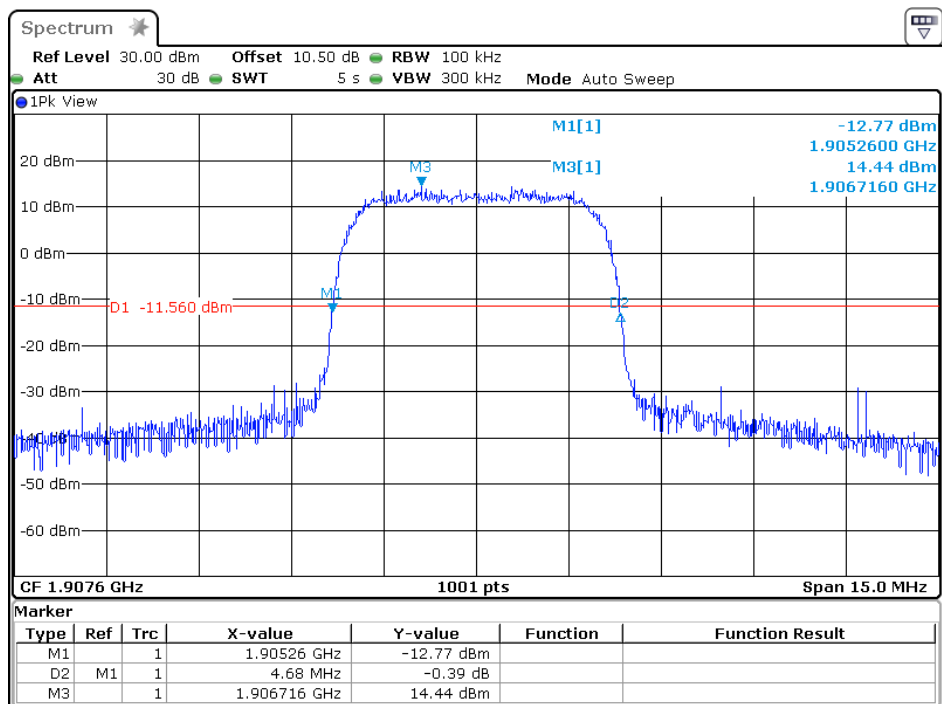


Date: 19.MAY.2023 10:22:12

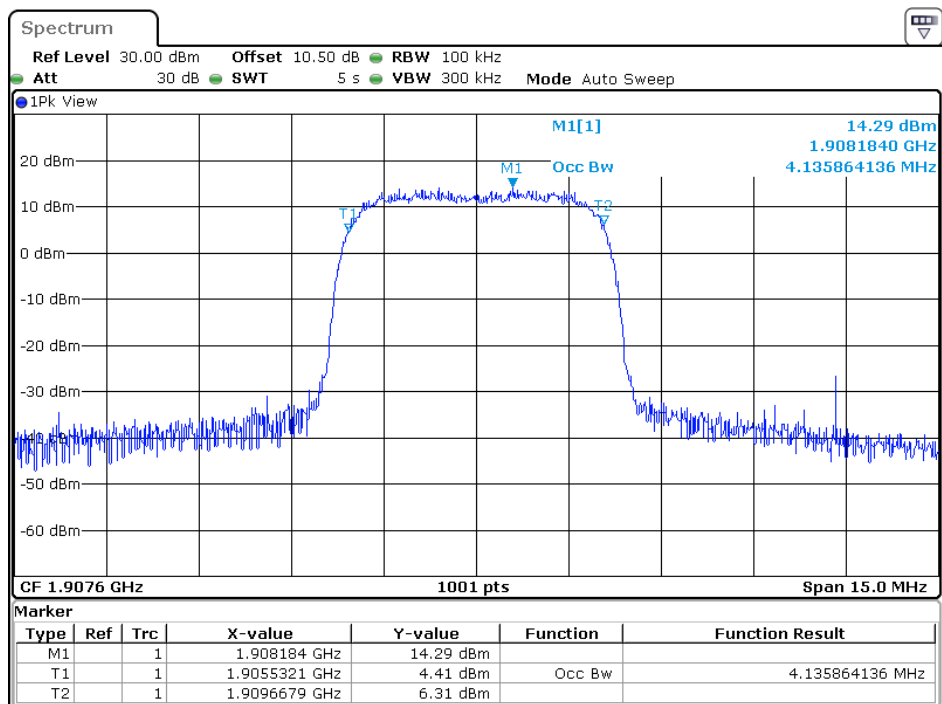


Date: 19.MAY.2023 10:21:30

26 dB Emissions & 99% Occupied Bandwidth for HSDPA (QPSK) Mode, High channel

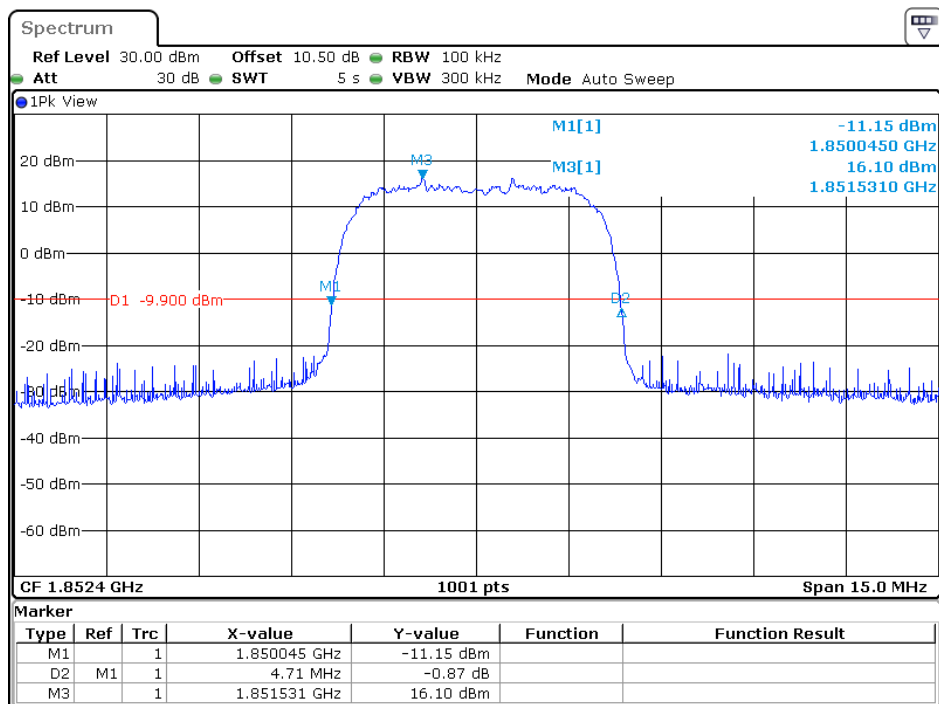


Date: 19.MAY.2023 10:32:46

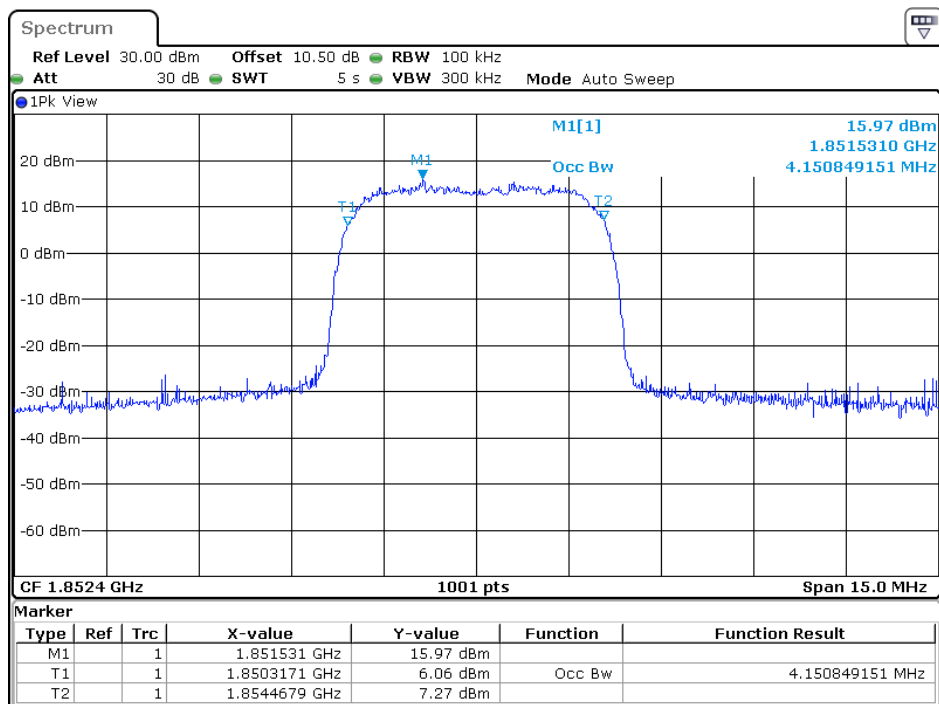


Date: 19.MAY.2023 10:31:13

26 dB Emissions & 99% Occupied Bandwidth for HSUPA (16QAM) Mode, Low channel

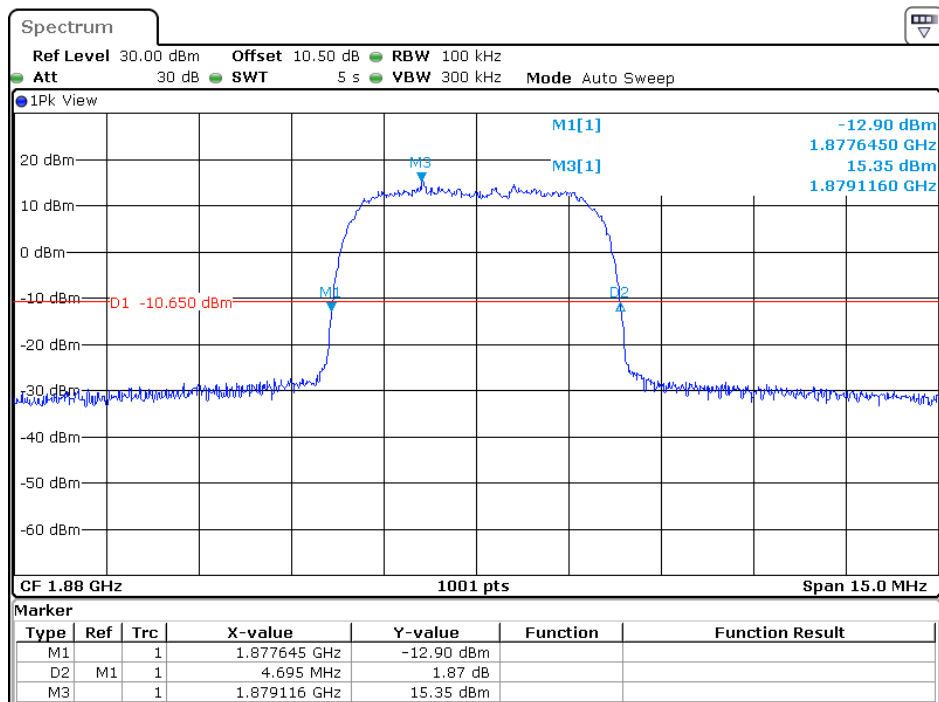


Date: 19.MAY.2023 10:39:50

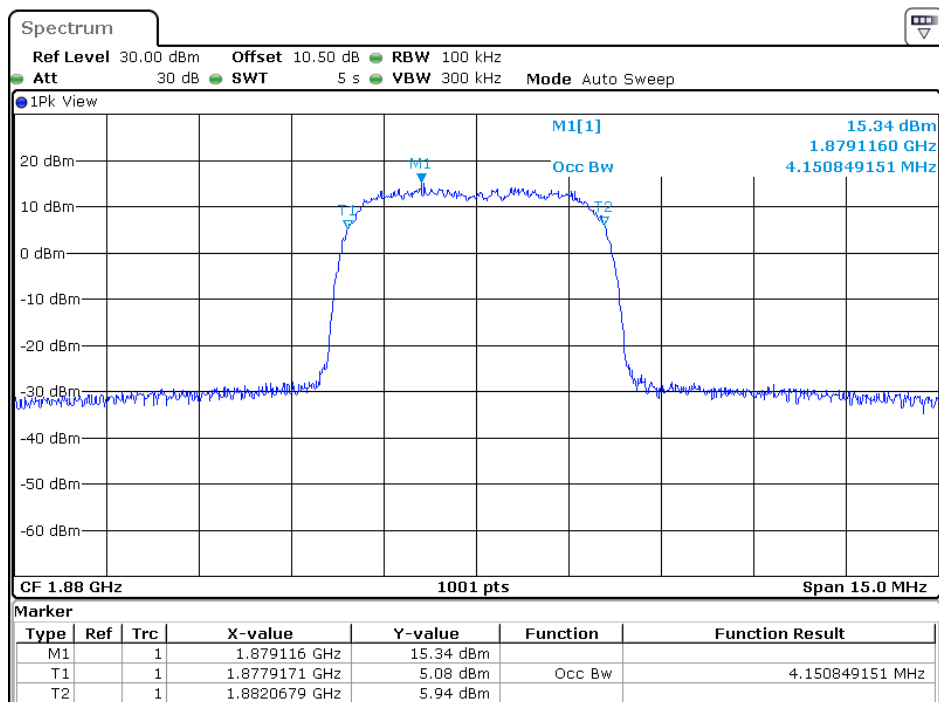


Date: 19.MAY.2023 10:36:50

26 dB Emissions & 99% Occupied Bandwidth for HSUPA (16QAM) Mode, Middle channel

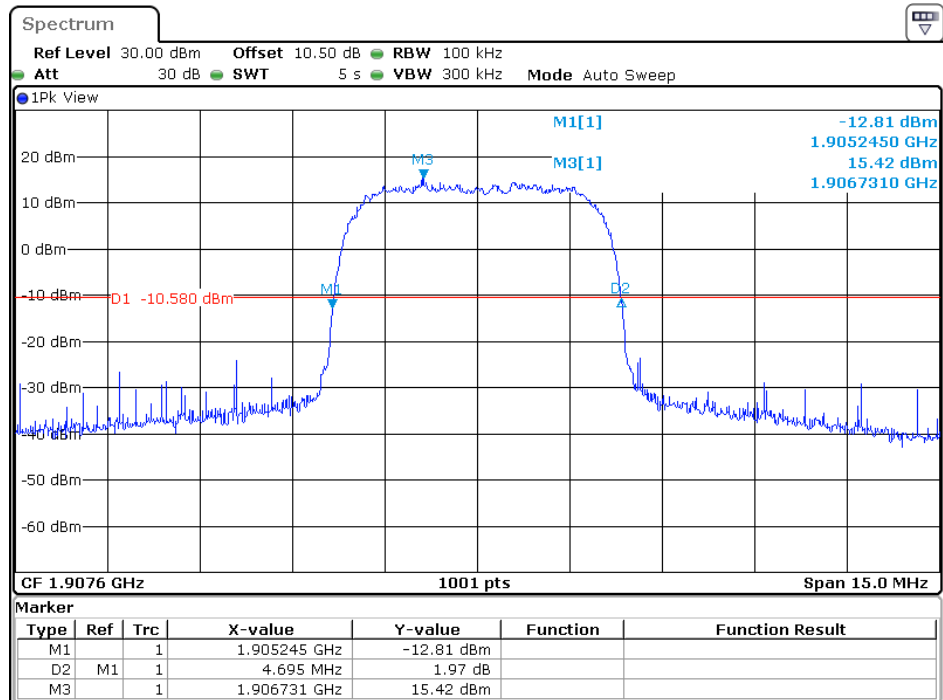


Date: 19.MAY.2023 10:44:29

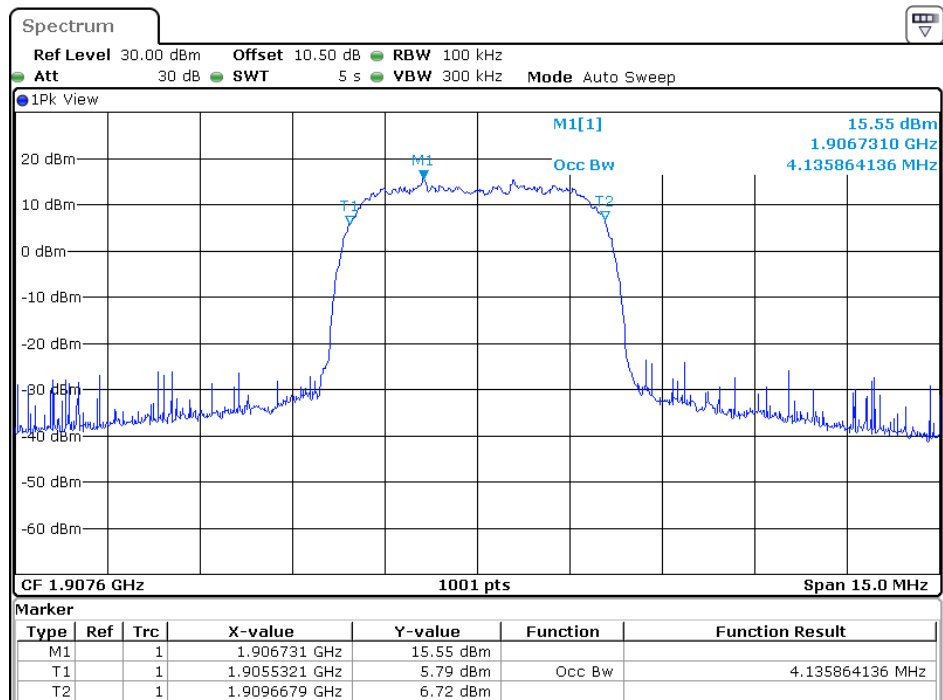


Date: 19.MAY.2023 10:43:31

26 dB Emissions & 99% Occupied Bandwidth for HSUPA (16QAM) Mode, High channel



Date: 19.MAY.2023 10:51:33



Date: 19.MAY.2023 10:50:51

LTE Band 2:

Bandwidth	Modulation	Low channel		Middle channel		High channel	
		OBW (MHz)	26dB EBW (MHz)	OBW (MHz)	26dB EBW (MHz)	OBW (MHz)	26dB EBW (MHz)
1.4 MHz	QPSK	1.096	1.308	1.102	1.326	1.102	1.302
	16QAM	1.102	1.320	1.096	1.302	1.102	1.308
3 MHz	QPSK	2.683	2.844	2.695	2.928	2.695	2.940
	16QAM	2.683	2.940	2.695	2.964	2.683	2.964
5 MHz	QPSK	4.511	5.040	4.511	5.020	4.511	5.040
	16QAM	4.531	5.060	4.511	5.060	4.511	5.020
10 MHz	QPSK	8.942	9.760	8.942	9.840	8.942	9.640
	16QAM	4.511	5.280	4.511	5.320	4.511	5.360
15 MHz	QPSK	13.473	14.700	13.413	14.700	13.473	14.760
	16QAM	4.551	5.400	4.551	5.400	4.551	5.340
20 MHz	QPSK	17.884	19.280	17.884	19.360	17.964	19.360
	16QAM	4.631	5.680	4.551	5.520	4.631	5.600

LTE Band 4:

Bandwidth	Modulation	Low channel		Middle channel		High channel	
		OBW (MHz)	26dB EBW (MHz)	OBW (MHz)	26dB EBW (MHz)	OBW (MHz)	26dB EBW (MHz)
1.4 MHz	QPSK	1.102	1.338	1.102	1.296	1.096	1.314
	16QAM	1.096	1.302	1.102	1.308	1.102	1.320
3 MHz	QPSK	2.683	2.964	2.695	2.940	2.695	3.192
	16QAM	2.683	2.940	2.695	2.964	2.683	2.940
5 MHz	QPSK	4.511	5.020	4.511	5.040	4.511	5.040
	16QAM	4.511	5.060	4.511	5.000	4.551	5.960
10 MHz	QPSK	8.942	9.720	8.942	9.800	8.942	9.720
	16QAM	4.551	5.400	4.551	5.360	4.511	5.320
15 MHz	QPSK	13.413	14.760	13.473	14.760	13.413	14.640
	16QAM	4.551	5.340	4.611	5.400	4.551	5.400
20 MHz	QPSK	17.884	19.280	17.884	19.280	17.884	19.200
	16QAM	4.551	5.600	4.711	5.680	4.551	5.440

LTE Band 12:

Bandwidth	Modulation	Low channel		Middle channel		High channel	
		OBW (MHz)	26dB EBW (MHz)	OBW (MHz)	26dB EBW (MHz)	OBW (MHz)	26dB EBW (MHz)
1.4 MHz	QPSK	1.102	1.290	1.096	1.314	1.102	1.320
	16QAM	1.102	1.302	1.102	1.314	1.096	1.296
3 MHz	QPSK	2.695	2.940	2.683	2.940	2.683	2.952
	16QAM	2.695	2.964	2.683	2.940	2.683	2.952
5 MHz	QPSK	4.531	5.020	4.511	5.040	4.491	5.040
	16QAM	4.491	5.020	4.531	5.020	4.531	5.020
10 MHz	QPSK	8.942	9.760	8.942	9.680	8.942	9.800
	16QAM	4.471	5.280	4.551	5.320	4.511	5.240

The test plots of LTE band please refer to the Appendix A.

FCC §2.1051, §22.917(a) & §24.238(a)& §27.53 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

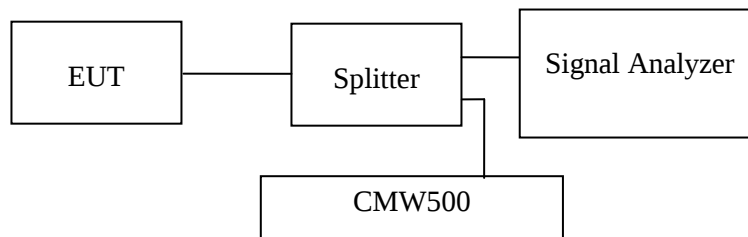
Applicable Standard

FCC §2.1051, §22.917(a) & §24.238(a), §27.53.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.



Note: the worst path loss (cable loss and splitter inset loss) among the test frequency range has included in plot.

Test Data

Environmental Conditions

Temperature:	24~27 °C
Relative Humidity:	52~60 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang from 2023-05-15 to 2023-05-19.

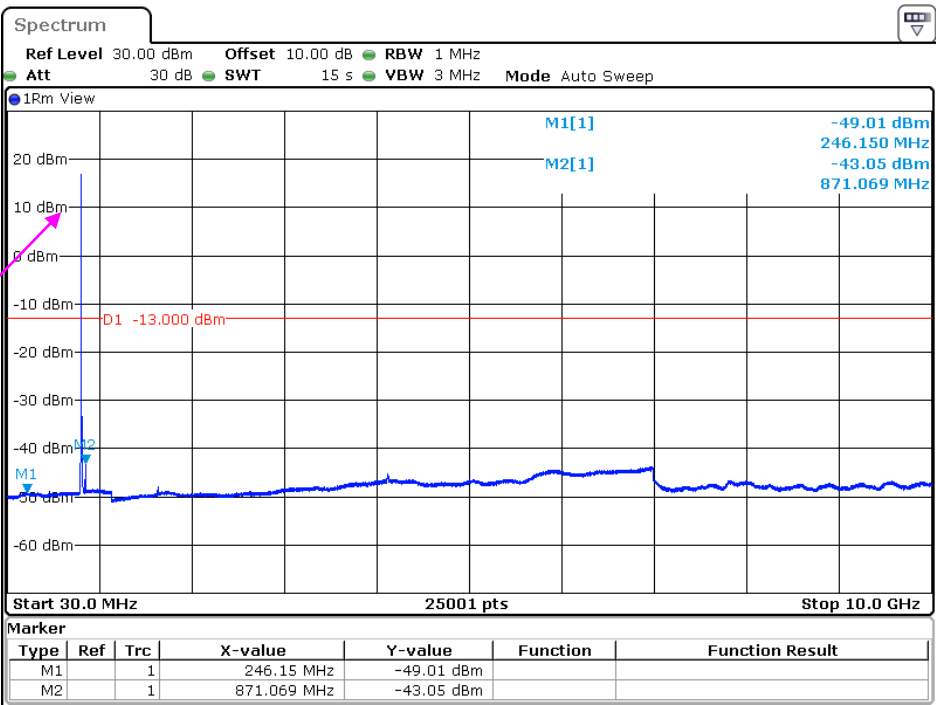
EUT operation mode: Transmitting

Test result: Pass

Please refer to the following plots.

Cellular Band (Part 22H)

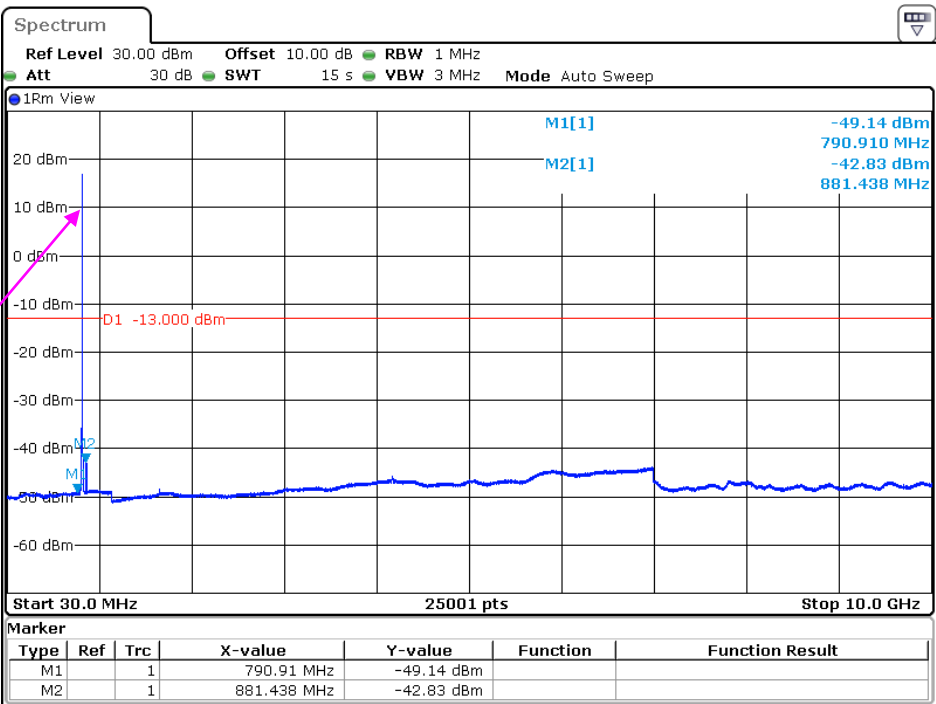
30 MHz – 10 GHz (WCDMA Mode)



Date: 19.MAY.2023 14:13:39

Middle Channel:

30 MHz – 10 GHz (WCDMA Mode)

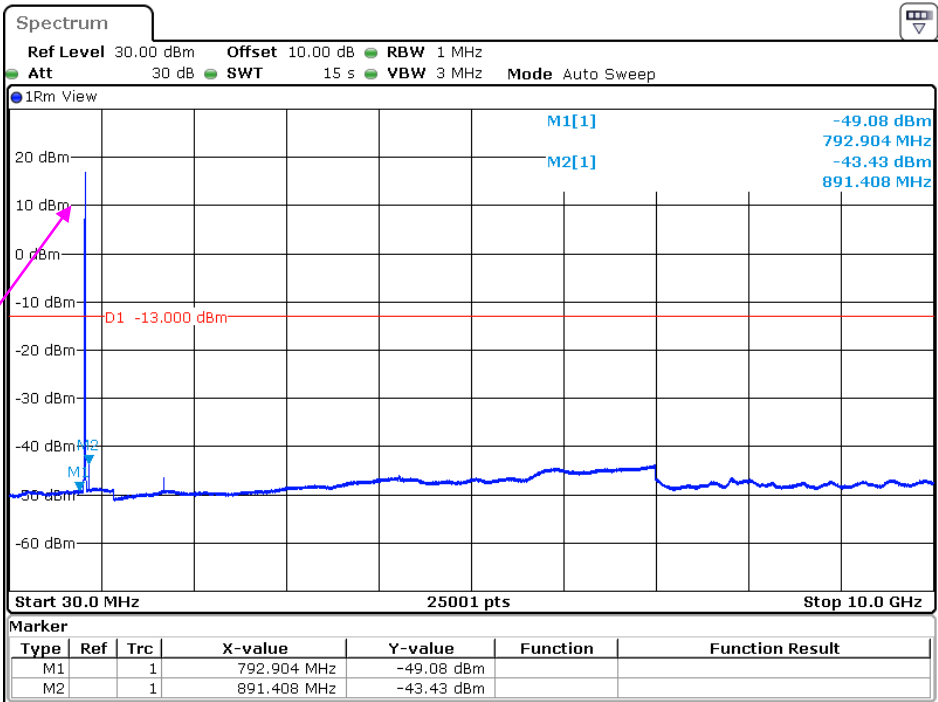


Date: 19.MAY.2023 11:16:04

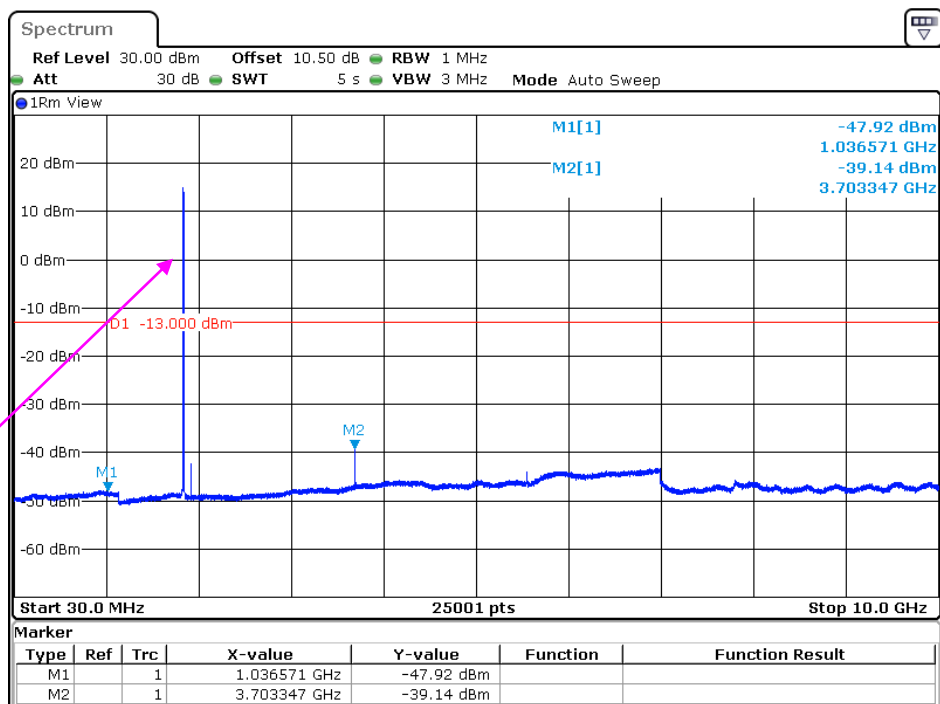
High Channel:

30 MHz – 10 GHz (WCDMA Mode)

Fundamental test

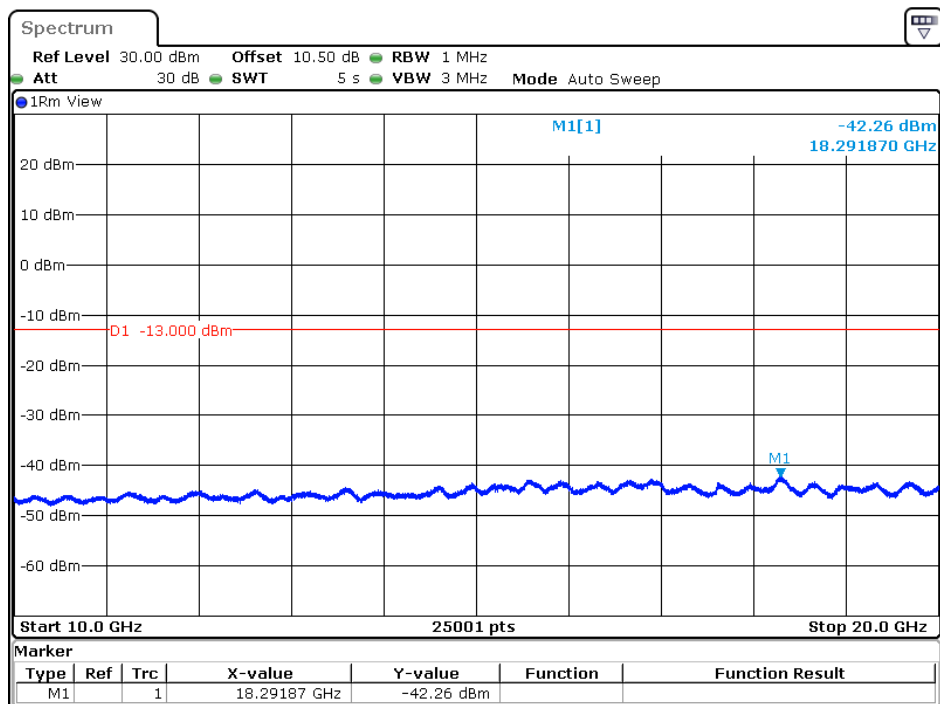


Date: 19.MAY.2023 11:19:47

PCS Band (Part 24E)**Low Channel:****30 MHz – 10 GHz (WCDMA Mode)**

Fundamental test

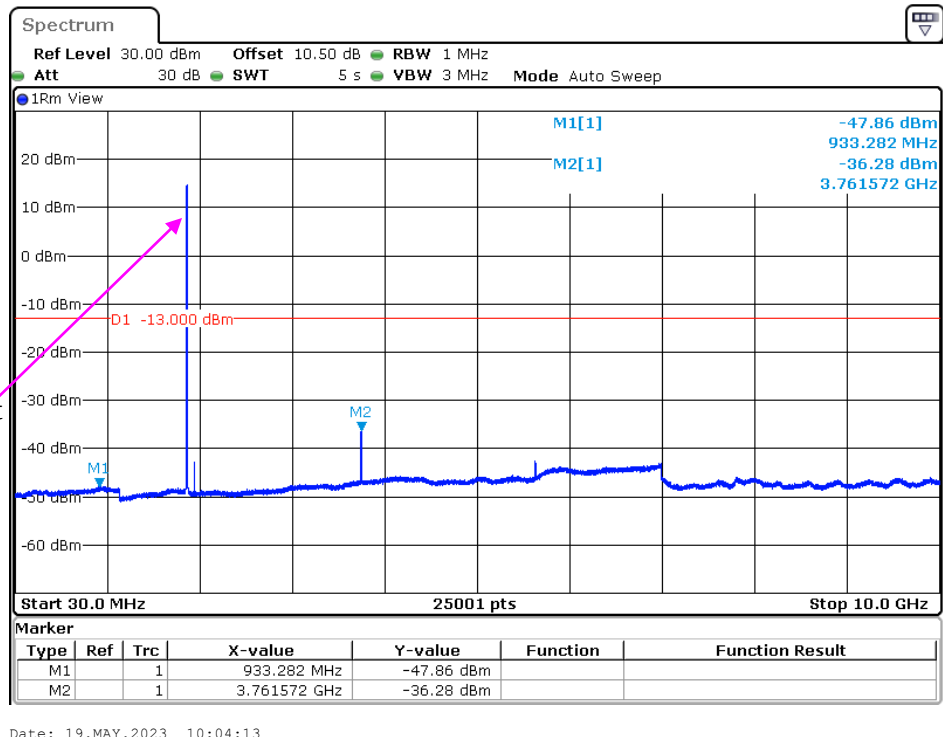
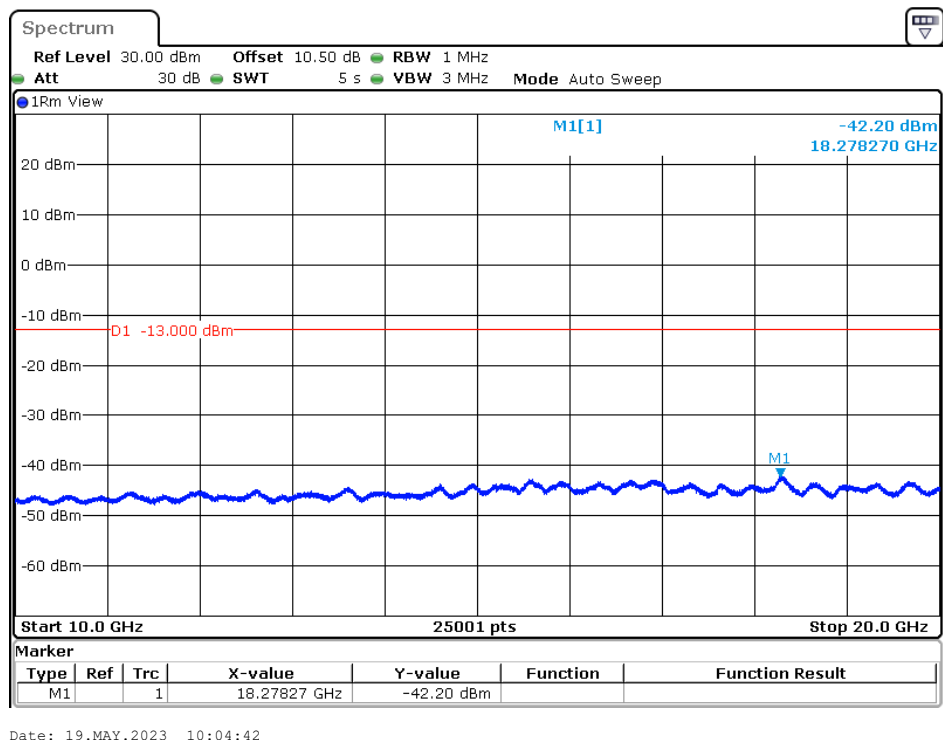
Date: 19.MAY.2023 09:59:39

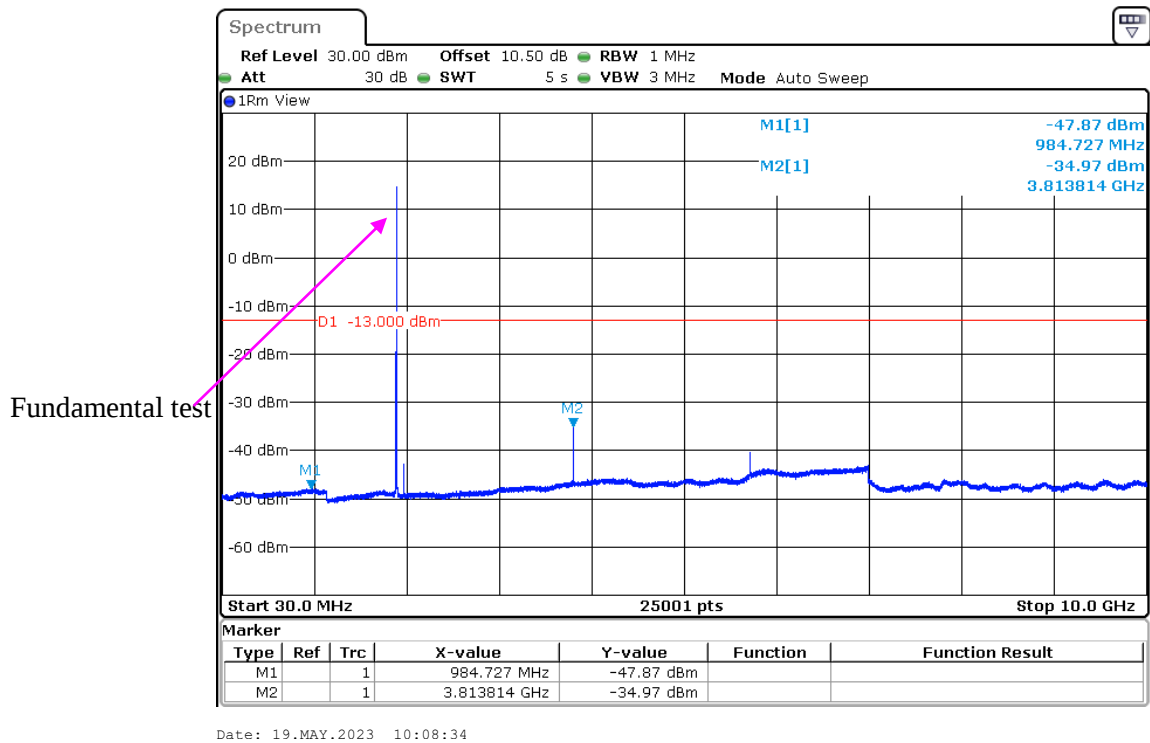
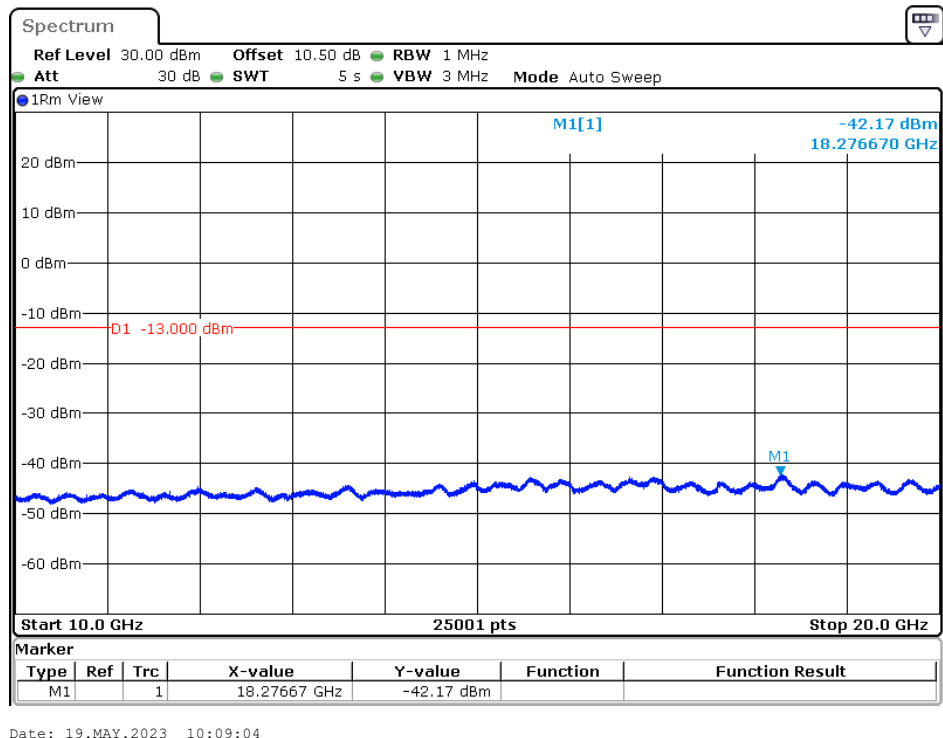
10 GHz – 20 GHz (WCDMA Mode)

Date: 19.MAY.2023 10:00:08

Middle Channel:**30 MHz – 10 GHz (WCDMA Mode)**

Fundamental test

**10 GHz – 20 GHz (WCDMA Mode)**

High Channel:**30 MHz – 10 GHz (WCDMA Mode)****10 GHz – 20 GHz (WCDMA Mode)**

The test plots of LTE band please refer to the Appendix B.

FCC § 2.1053; § 22.917 (a); § 24.238 (a); § 27.53- SPURIOUS RADIATED EMISSIONS

Applicable Standard

FCC § 2.1053, §22.917(a) & § 24.238(a) & § 27.53.

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the receiving antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Test Data

Environmental Conditions

Temperature:	24°C
Relative Humidity:	60.5 %
ATM Pressure:	101.2 kPa

The testing was performed by Jason Liu on 2023-05-10.

Test mode: Transmitting (Pre-scan in the X, Y and Z axes of orientation, the worst case Y-axis of orientation was recorded)

The worst case is as below:

30MHz-10GHz:**Cellular Band (Part 22H)**

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
WCDMA Band5, 826.4MHz								
1652.8	-23.4	129	1.1	H	0.4	-19.9	-13	-28.6
1652.8	-31.1	270	1.4	V	0.2	-28	-13	-21
2479.2	-45.5	227	2.2	H	3.6	-38.9	-13	-29.3
2479.2	-48.5	7	1.9	V	4.1	-42.7	-8.9	-27.6
3305.6	-48.7	64	1.4	H	4.1	-42.3	-13	-28.5
3305.6	-50.1	21	1.4	V	4.3	-44.4	-13	-29.3
WCDMA Band5, 836.6MHz								
1673.2	-29.5	332	1.9	H	0.5	-25.7	-13	-28.3
1673.2	-36.3	100	1	V	0.5	-33.2	-13	-18
2509.8	-44.1	160	2.1	H	3.6	-37.9	-13	-28.7
2509.8	-47.5	7	1.6	V	3.9	-42	-13	-27.4
3346.4	-47	333	1.7	H	4.1	-40.4	-13	-27.9
3346.4	-49.9	16	1.7	V	4.1	-44.5	-13	-29.1
WCDMA Band5, 846.6MHz								
1693.2	-25.2	327	2.1	H	0.5	-21.1	-13	-32.9
1693.2	-30.9	101	1.9	V	0.5	-27.8	-13	-29.1
2539.8	-50.5	170	1.8	H	3.6	-44.4	-13	-30.2
2539.8	-55.2	175	1.9	V	3.9	-49.4	-13	-28.6
3386.4	-45.4	212	1.3	H	4.1	-39.2	-13	-24.9
3386.4	-49.1	239	1.7	V	4.1	-43.7	-13	-25

30MHz-20GHz:**PCS Band (Part 24E)**

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substitute d Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
WCDMA Band2,1852.4MHz								
3704.8	-76.4	224	1.8	H	5.9	-67.2	-13	-25
3704.8	-77.78	13	1.7	V	6.4	-66.78	-13	-24.5
5557.2	-48.4	192	1.2	H	9.1	-40.3	-13	-20.5
5557.2	-51	283	2	V	9.5	-43.4	-13	-22
WCDMA Band2,1880MHz								
3760	-77.9	205	2.1	H	6.2	-68.7	-13	-20.9
3760	-77.85	298	1.7	V	6.7	-66.85	-13	-12.8
5640	-49.1	300	1.5	H	9.1	-40.3	-13	-20.9
5640	-51.9	219	2	V	9.3	-43.9	-13	-20.7
WCDMA Band2,1907.6MHz								
3815.2	-77.64	124	2	H	6.2	-68.44	-13	-24.2
3815.2	-77.62	178	2	V	6.4	-66.62	-13	-24.5
5722.8	-45.4	119	1.7	H	9.1	-36.7	-13	-19.8
5722.8	-48	165	1.3	V	9.5	-40	-13	-20

LTE Band: (Pre-scan all bandwidth/modulation, the worst case as below)

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
Band 2								
Test frequency range: 30MHz-20GHz								
1.4MHz bandwidth, QPSK, Low channel								
3701.4	-45.3	256	1.1	H	5.9	-39.4	-13	-26.4
3701.4	-47.0	24	1.1	V	6.4	-40.6	-13	-27.6
5552.1	-39.8	13	1.0	H	9.1	-30.7	-13	-17.7
5552.1	-37.1	67	2.2	V	9.5	-27.6	-13	-14.6
1.4MHz bandwidth, QPSK, Middle channel								
3760	-39.4	282	2.2	H	6.2	-33.2	-13	-20.2
3760	-31.5	313	1.9	V	6.7	-24.8	-13	-11.8
5640	-42.9	269	2.2	H	9.1	-33.8	-13	-20.8
5640	-43.7	27	2.0	V	9.3	-34.4	-13	-21.4
1.4MHz bandwidth, QPSK, High channel								
3818.6	-44.9	236	2.0	H	6.1	-38.8	-13	-25.8
3818.6	-46.5	166	2.0	V	6.4	-40.1	-13	-27.1
5727.9	-41.1	323	1.2	H	9.1	-32.0	-13	-19.0
5727.9	-38.1	173	1.1	V	9.5	-28.6	-13	-15.6

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
Band 4								
Test frequency range: 30MHz-20GHz								
1.4MHz bandwidth, QPSK, Low channel								
3421.4	-42.9	55	1.3	H	4.8	-38.1	-13	-25.1
3421.4	-40.9	95	1.3	V	5.3	-35.6	-13	-22.6
5132.1	-42.1	51	1.6	H	9.0	-33.1	-13	-20.1
5132.1	-39.3	59	1.7	V	9.3	-30.0	-13	-17.0
1.4MHz bandwidth, QPSK, Middle channel								
3465	-30.4	205	2.3	H	5.3	-25.1	-13	-12.1
3465	-33.2	294	2.4	V	5.5	-27.7	-13	-14.7
5197.5	-43.1	227	1.4	H	8.4	-34.7	-13	-21.7
5197.5	-42.5	148	2.2	V	8.9	-33.6	-13	-20.6
1.4MHz bandwidth, QPSK, High channel								
3508.6	-43.8	194	1.6	H	5.7	-38.1	-13	-25.1
3508.6	-44.4	344	1.2	V	5.9	-38.5	-13	-25.5
5262.9	-40.5	83	1.1	H	8.3	-32.2	-13	-19.2
5262.9	-37.8	275	1.9	V	8.5	-29.3	-13	-16.3

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
Band 12								
Test frequency range: 30MHz-10GHz								
1.4MHz bandwidth, QPSK, Low channel								
1399.4	-51.7	308	1.6	H	1.6	-50.1	-13	-37.1
1399.4	-49.8	329	1.7	V	1.8	-48	-13	-35.0
2099.1	-39.8	209	1.2	H	3.8	-36	-13	-23.0
2099.1	-37.5	15	1.5	V	3.8	-33.7	-13	-20.7
2798.8	-44.4	280	2.4	H	3.8	-40.6	-13	-27.6
2798.8	-46.0	141	1.7	V	4.5	-41.5	-13	-28.5
1.4MHz bandwidth, QPSK, Middle channel								
1415	-44.0	3	1.4	H	1.7	-42.3	-13	-29.3
1415	-45.1	155	1.9	V	1.8	-43.3	-13	-30.3
2122.5	-40.8	283	1.9	H	4.0	-36.8	-13	-23.8
2122.5	-42.1	112	1.5	V	4.0	-38.1	-13	-25.1
2830	-49.8	195	2.4	H	4.2	-45.6	-13	-32.6
2830	-49.8	40	2.4	V	4.7	-45.1	-13	-32.1
1.4MHz bandwidth, QPSK, High channel								
1430.6	-52.3	200	2.3	H	1.7	-50.6	-13	-37.6
1430.6	-49.4	194	2.0	V	1.8	-47.6	-13	-34.6
2145.9	-38.2	100	2.4	H	4.2	-34	-13	-21.0
2145.9	-38.9	214	2.0	V	4.2	-34.7	-13	-21.7
2861.2	-44.4	100	2.4	H	4.6	-39.8	-13	-26.8
2861.2	-45.9	262	1.1	V	4.8	-41.1	-13	-28.1

Note:

Absolute Level = Reading Level + Substituted Factor

Substituted Factor contains: Substituted Level - Cable loss+ Antenna Gain

Margin = Absolute Level – Limit

Other emissions which was more than 20dB below limit was not recorded

FCC § 22.917 (a); § 24.238 (a); §27.53 (g) (h)- BAND EDGES

Applicable Standard

According to § 22.917(a), the power of any emissions 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.

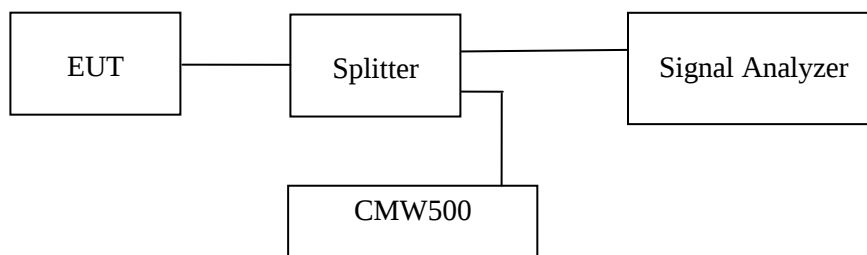
According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

According to FCC §27.53 (g)(h), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency



Note: the worst path loss (cable loss and splitter inset loss) among the test frequency range has included in plot.

Test Data

Environmental Conditions

Temperature:	24~27 °C
Relative Humidity:	52~60 %
ATM Pressure:	101.0 kPa

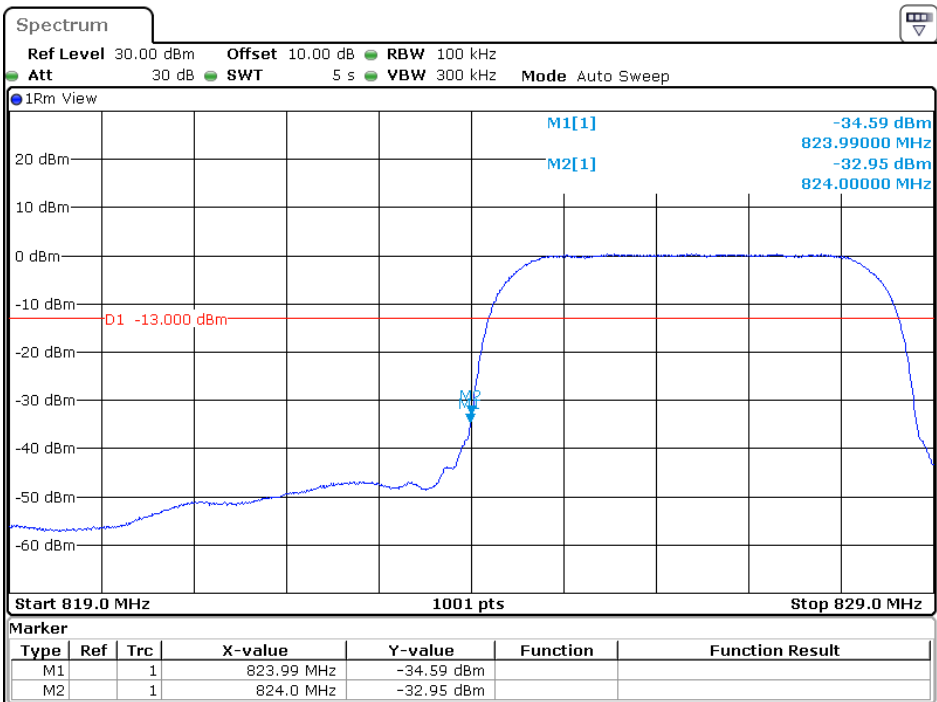
The testing was performed by Jacob Huang from 2023-05-15 to 2023-05-19.

EUT operation mode: Transmitting (Worst case)

Test Result: Pass

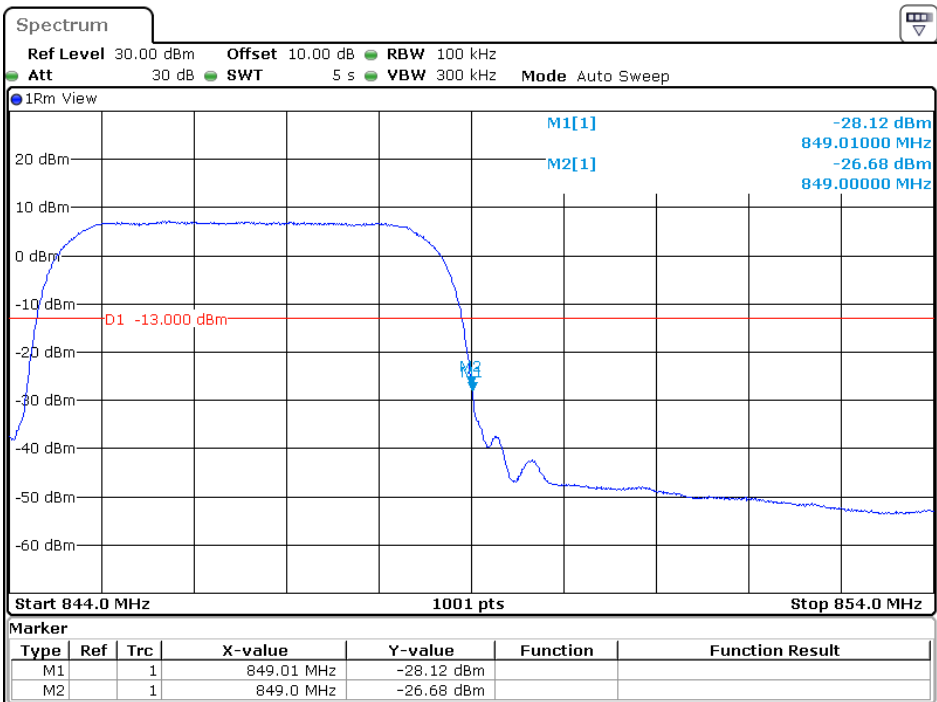
Please refer to the following plots.

Cellular Band, Left Band Edge for RMC (BPSK) Mode



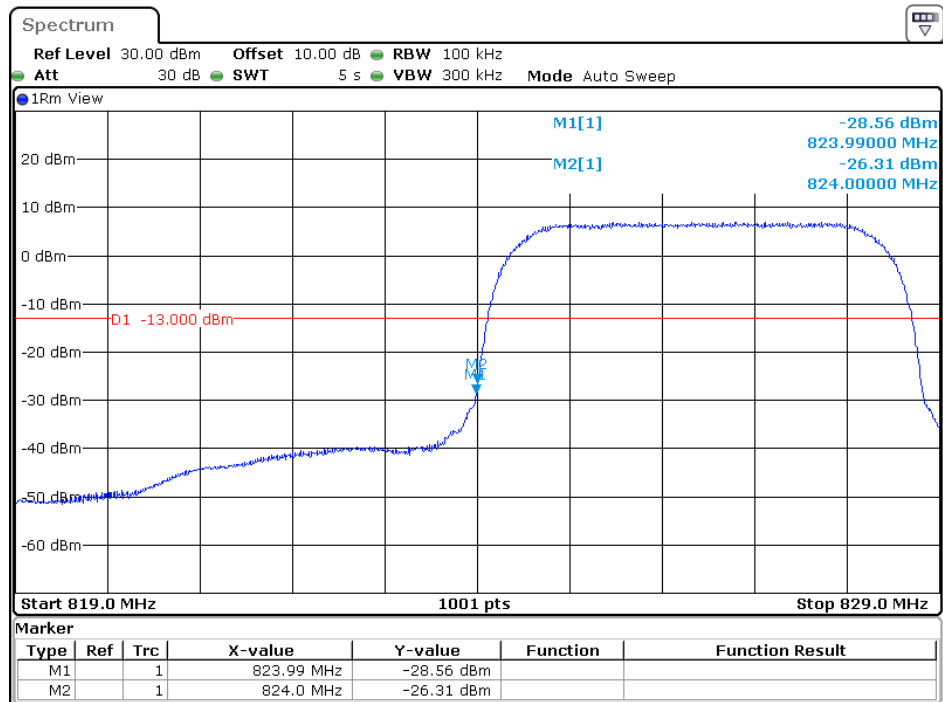
Date: 19.MAY.2023 14:11:10

Cellular Band, Right Band Edge for RMC (BPSK) Mode



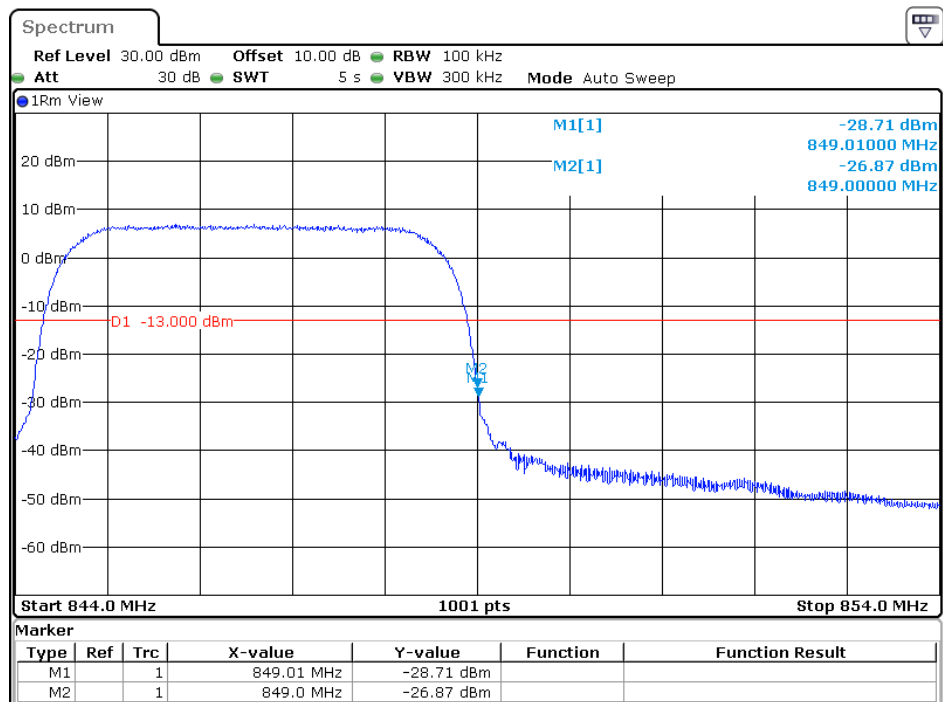
Date: 19.MAY.2023 11:18:59

Cellular Band, Left Band Edge for HSDPA(16QAM) Mode



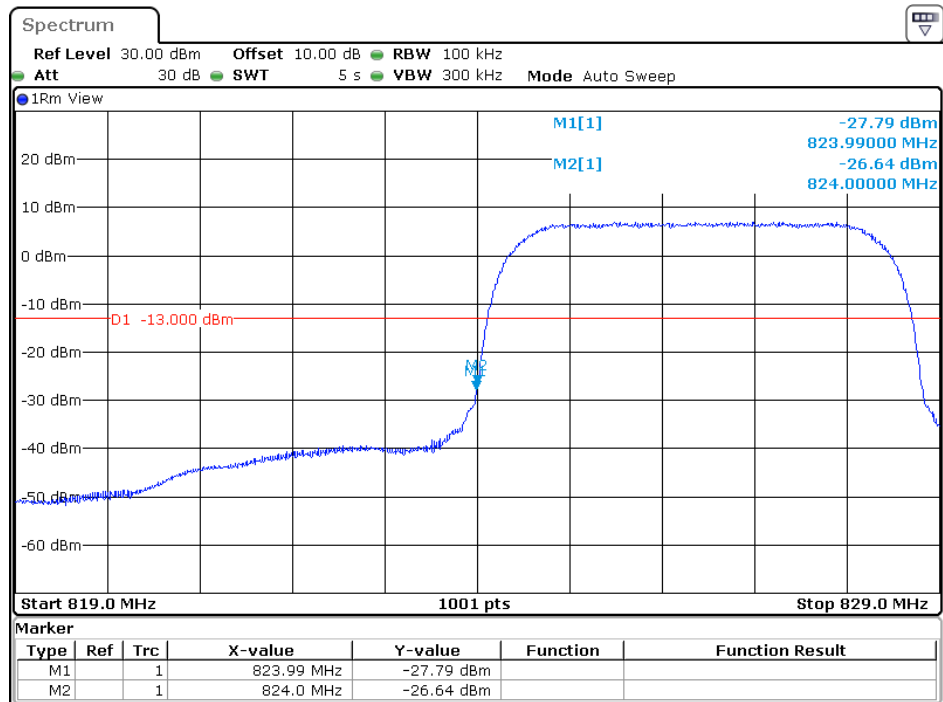
Date: 19.MAY.2023 14:18:04

Cellular Band, Right Band Edge for HSDPA (16QAM) Mode



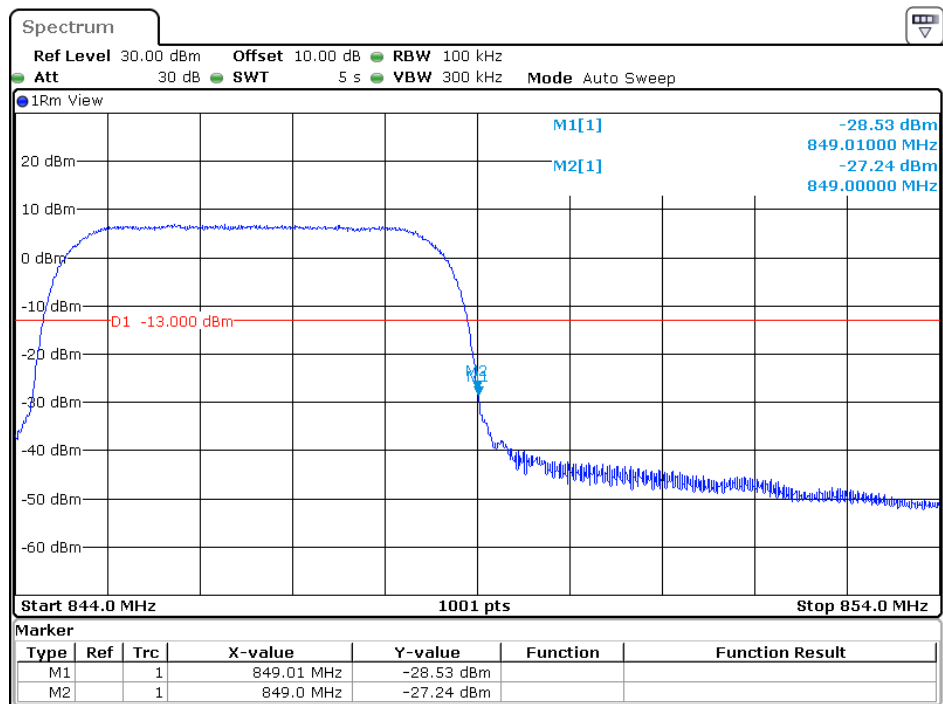
Date: 19.MAY.2023 11:34:30

Cellular Band, Left Band Edge for HSUPA (QPSK) Mode



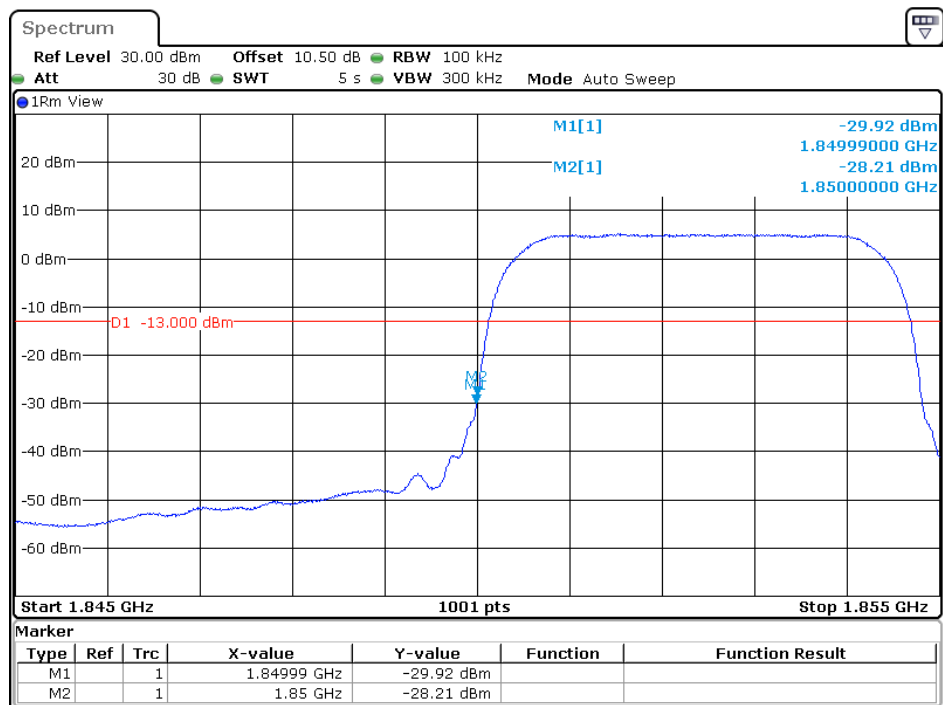
Date: 19.MAY.2023 14:23:44

Cellular Band, Right Band Edge for HSUPA (QPSK) Mode



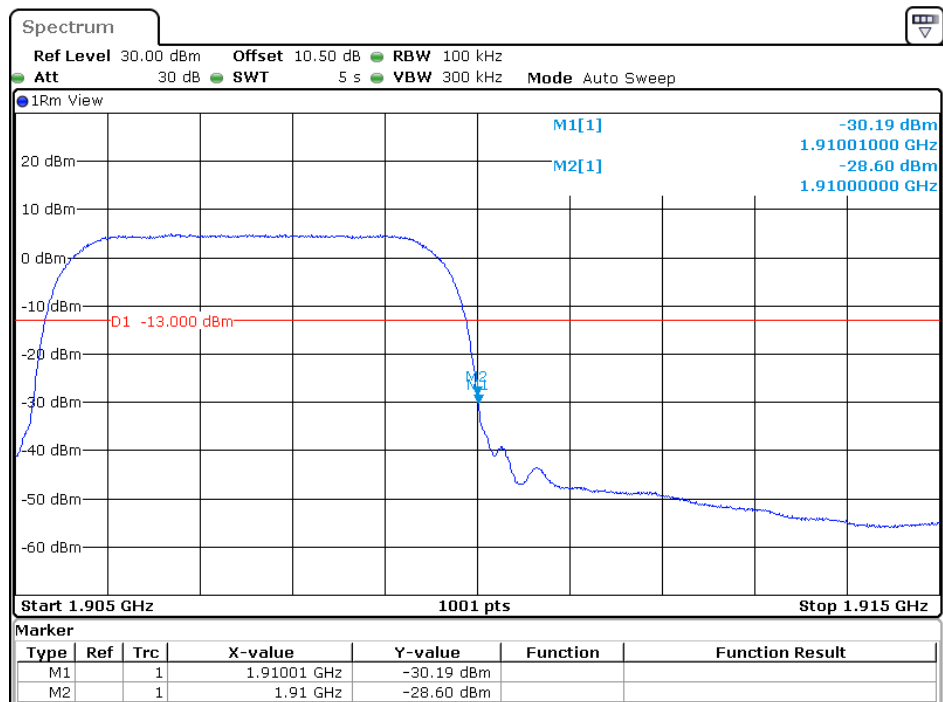
Date: 19.MAY.2023 11:55:18

PCS Band, Left Band Edge for RMC (BPSK) Mode



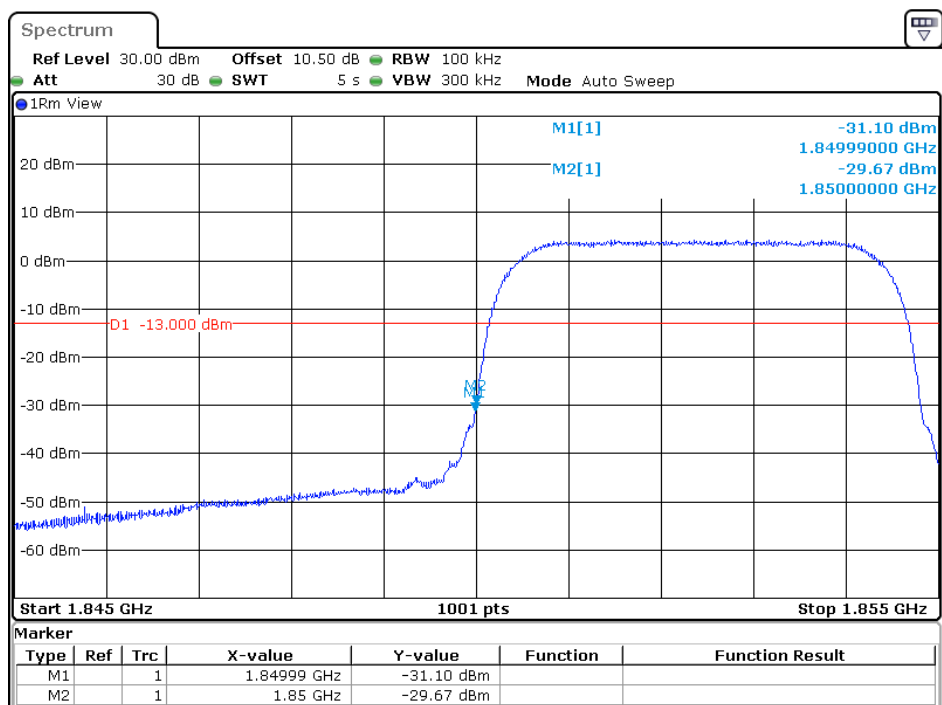
Date: 19.MAY.2023 09:59:11

PCS Band, Right Band Edge for RMC (BPSK) Mode



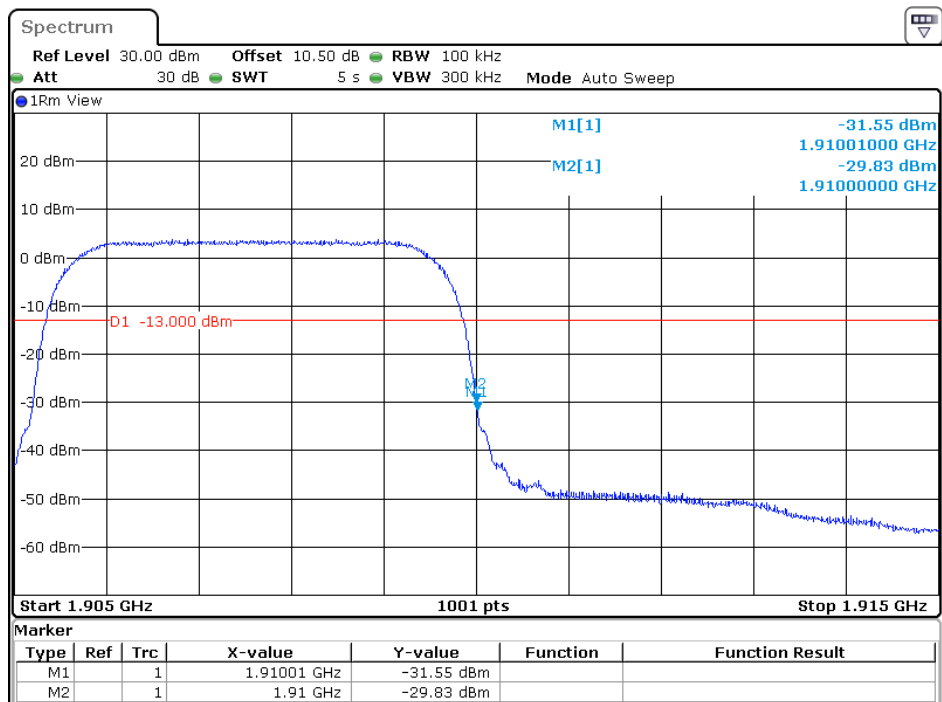
Date: 19.MAY.2023 10:08:06

PCS Band, Left Band Edge for HSDPA(16QAM) Mode

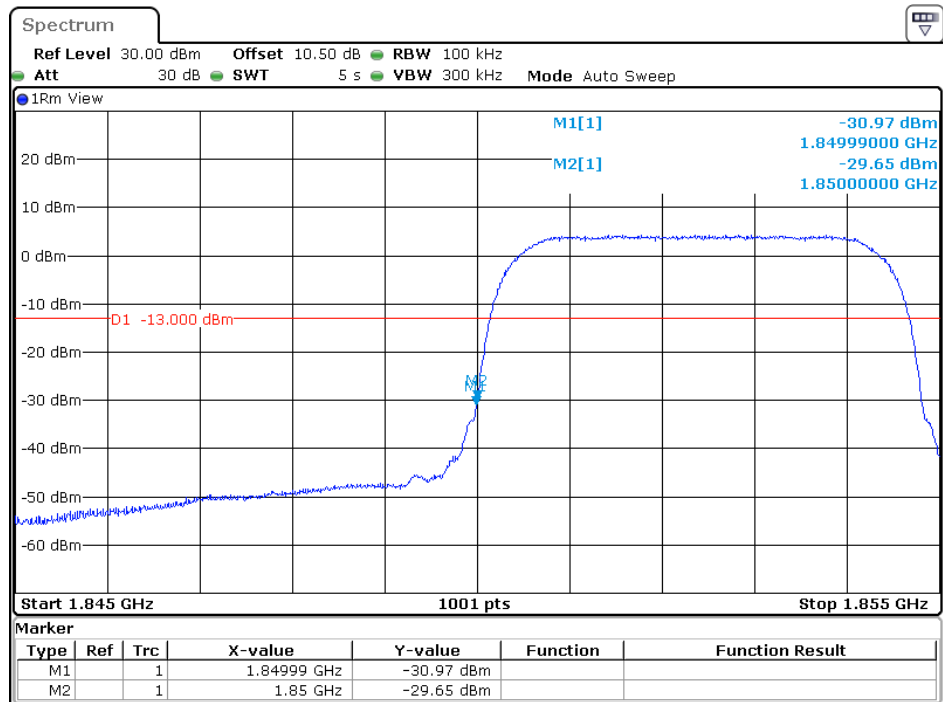


Date: 19.MAY.2023 10:18:56

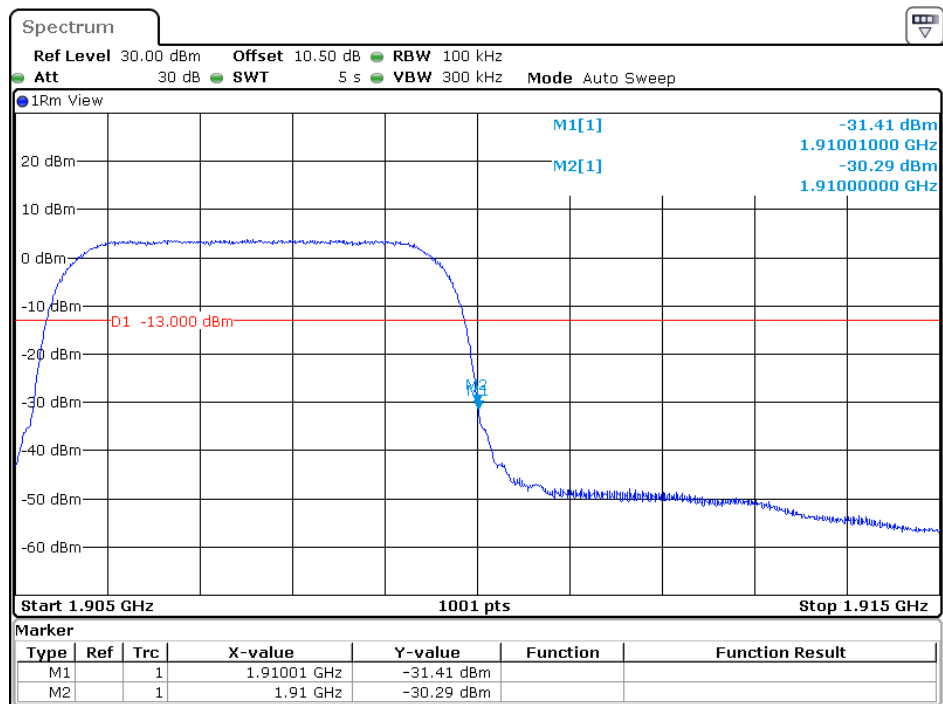
PCS Band, Right Band Edge for HSDPA (16QAM) Mode



Date: 19.MAY.2023 10:33:14

PCS Band, Left Band Edge for HSUPA (QPSK) Mode

Date: 19.MAY.2023 10:40:17

PCS Band, Right Band Edge for HSUPA (QPSK) Mode

Date: 19.MAY.2023 10:52:00

The test plots of LTE bands please refer to the Appendix C.

FCC § 2.1055; § 22.355; § 24.235; §27.54 - FREQUENCY STABILITY

Applicable Standard

FCC § 2.1055, §22.355, §24.235& §27.54 .

According to FCC §2.1055, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency Range (MHz)	Base, fixed (ppm)	Mobile ≤ 3 watts (ppm)	Mobile > 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929.	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

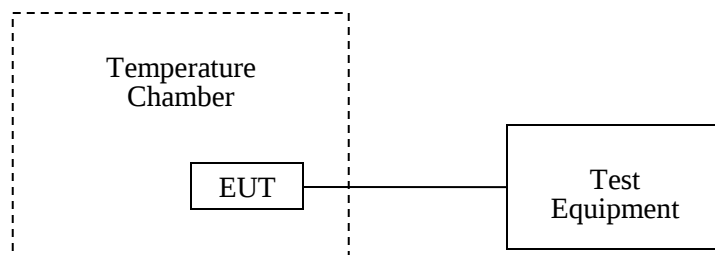
According to §24.235& §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



Test Data**Environmental Conditions**

Temperature:	24~27 °C
Relative Humidity:	52~60 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Huang from 2023-05-14 to 2023-05-19.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the following tables.(worst case listed)

Cellular Band (Part 22H)**WCDMA Mode****Band 5**

Middle Channel, $f_0 = 836.6\text{MHz}$				
Temperature (°C)	Voltage Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	N.V.	8	0.0096	2.5
-20		6	0.0072	2.5
-10		11	0.0131	2.5
0		-6	-0.0072	2.5
10		5	0.0060	2.5
20		-2	-0.0024	2.5
30		5	0.0060	2.5
40		-6	-0.0072	2.5
50		-8	-0.0096	2.5
20	L.V.	6	0.0072	2.5
	H.V.	-4	-0.0048	2.5

PCS Band (Part 24E)**Band 2**

Middle Channel, $f_0 = 1880\text{MHz}$					
Temperature (°C)	Power Supplied (V_{DC})	F_L (MHz)	F_H (MHz)	F_L Limit (MHz)	F_H Limit (MHz)
-30	N.V.	1850.0181	1909.9890	1850	1910
-20		1850.0175	1909.9839	1850	1910
-10		1850.0147	1909.9873	1850	1910
0		1850.0223	1909.9984	1850	1910
10		1850.0324	1909.9919	1850	1910
20		1850.0208	1909.9821	1850	1910
30		1850.0324	1909.9966	1850	1910
40		1850.0203	1909.9678	1850	1910
50		1850.0102	1909.9810	1850	1910
20	L.V.	1850.0285	1909.9716	1850	1910
	H.V.	1850.0201	1909.9802	1850	1910

LTE:
QPSK:
Band 2:

10 MHz Bandwidth					
Temperature (°C)	Power Supplied (V_{DC})	F_L (MHz)	F_H (MHz)	F_L Limit (MHz)	F_H Limit (MHz)
-30	N.V.	1850.1587	1909.8729	1850	1910
-20		1850.1675	1909.8829	1850	1910
-10		1850.1738	1909.8873	1850	1910
0		1850.1532	1909.8651	1850	1910
10		1850.1691	1909.8694	1850	1910
20		1850.1678	1909.8857	1850	1910
30		1850.1636	1909.8656	1850	1910
40		1850.1615	1909.8587	1850	1910
50		1850.1347	1909.8732	1850	1910
20	L.V.	1850.1371	1909.8761	1850	1910
	H.V.	1850.1242	1909.8819	1850	1910

Band 4:

10 MHz Bandwidth					
Temperature (°C)	Power Supplied (V _{DC})	F _L (MHz)	F _H (MHz)	F _L Limit (MHz)	F _H Limit (MHz)
-30	N.V.	1710.1265	1754.9765	1710	1755
-20		1710.1231	1754.9765	1710	1755
-10		1710.1265	1754.9665	1710	1755
0		1710.1358	1754.9845	1710	1755
10		1710.1269	1754.9784	1710	1755
20		1710.1253	1754.9826	1710	1755
30		1710.1291	1754.9836	1710	1755
40		1710.1169	1754.9951	1710	1755
50		1710.1289	1754.9854	1710	1755
20	L.V.	1710.1251	1754.9768	1710	1755
	H.V.	1710.1126	1754.9852	1710	1755

Band 12:

10 MHz Bandwidth					
Temperature (°C)	Power Supplied (V _{DC})	F _L (MHz)	F _H (MHz)	F _L Limit (MHz)	F _H Limit (MHz)
-30	N.V.	699.1315	715.8765	699	716
-20		699.3635	715.8864	699	716
-10		699.1264	715.8408	699	716
0		699.1284	715.8723	699	716
10		699.1306	715.8513	699	716
20		699.1262	715.8674	699	716
30		699.1202	715.8818	699	716
40		699.1288	715.8711	699	716
50		699.1178	715.8794	699	716
20	L.V.	699.1246	715.8818	699	716
	H.V.	699.1204	715.8829	699	716

16QAM:**Band 2:**

10 MHz Bandwidth					
Temperature (°C)	Power Supplied (V _{DC})	F _L (MHz)	F _H (MHz)	F _L Limit (MHz)	F _H Limit (MHz)
-30	N.V.	1850.1743	1909.7715	1850	1910
-20		1850.1582	1909.7845	1850	1910
-10		1850.1791	1909.7922	1850	1910
0		1850.1644	1909.7724	1850	1910
10		1850.1867	1909.7660	1850	1910
20		1850.1744	1909.8009	1850	1910
30		1850.1765	1909.7730	1850	1910
40		1850.1981	1909.7658	1850	1910
50		1850.1667	1909.7728	1850	1910
20	L.V.	1850.1737	1909.7914	1850	1910
	H.V.	1850.1693	1909.7941	1850	1910

Band 4:

10 MHz Bandwidth					
Temperature (°C)	Power Supplied (V _{DC})	F _L (MHz)	F _H (MHz)	F _L Limit (MHz)	F _H Limit (MHz)
-30	N.V.	1710.1265	1754.9365	1710	1755
-20		1710.1231	1754.9265	1710	1755
-10		1710.1265	1754.9965	1710	1755
0		1710.1358	1754.9845	1710	1755
10		1710.1269	1754.9784	1710	1755
20		1710.1253	1754.9126	1710	1755
30		1710.1191	1754.9236	1710	1755
40		1710.1369	1754.9951	1710	1755
50		1710.1289	1754.9254	1710	1755
20	L.V.	1710.1251	1754.9368	1710	1755
	H.V.	1710.1126	1754.9452	1710	1755

Band 12:

10 MHz Bandwidth					
Temperature (°C)	Power Supplied (V _{DC})	F _L (MHz)	F _H (MHz)	F _L Limit (MHz)	F _H Limit (MHz)
-30	N.V.	699.1698	715.8811	699	716
-20		699.1735	715.8833	699	716
-10		699.1483	715.8564	699	716
0		699.1463	715.8891	699	716
10		699.1298	715.8533	699	716
20		699.1536	715.8784	699	716
30		699.1235	715.8405	699	716
40		699.1258	715.8489	699	716
50		699.1108	715.8649	699	716
20	L.V.	699.1694	715.8952	699	716
	H.V.	699.1624	715.8709	699	716

******* END OF REPORT *******