



TESTING LABORATORY
CERTIFICATE#4323.01



FCC PART 22H
FCC PART 24E, PART 27
MEASUREMENT AND TEST REPORT

For

Roadefend Vision Technology (Shanghai) Co.,Ltd

Room 602 604, 1st Building, No. 65 Chifeng Road, shanghai 200092, China

FCC ID: 2ACYXRDT401B

Report Type: Original Report	Product Type: Driver State Monitor System
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Roadefend Vision Technology (Shanghai) Co.,Ltd
Tested Model	RDT401B
Product Type	Driver State Monitor System
Power Supply	DC 9-36V
RF Function:	GSM, WCDMA, LTE
Operating Band/Frequency:	GSM850: 824-849 MHz(TX), 869-894 MHz(RX) PCS1900: 1850-1910 MHz(TX), 1930-1990MHz(RX) WCDMA Band II: 1850-1910 MHz(TX), 1930-1990MHz(RX) WCDMA Band V: 824-849 MHz(TX), 869-894 MHz(RX) LTE Band 2: 1850-1910 MHz(TX), 1930-1990MHz(RX) LTE Band 4: 1710-1755 MHz(TX), 2110-2155MHz(RX) LTE Band 5: 824-849 MHz(TX), 869-894 MHz(RX)
Power Class:	WCDMA/LTE: Class 3
Modulation Type:	GSM: GMSK/8PSK WCDMA: BPSK,QPSK,16QAM LTE: QPSK,16QAM
Antenna Type:	GSM/WCDMA/LTE: External Antenna
Maximum Antenna Gain:	GSM/WCDMA/LTE: 2dBi

**All measurement and test data in this report was gathered from production sample serial number: 20200302001. (Assigned by the BACL. The EUT supplied by the applicant was received on 2020-03-02)*

Objective

This type approval report is prepared on behalf of Roadefend Vision Technology (Shanghai) Co.,Ltd in accordance with Part 2, Part 22-Subpart H and Part 24-Subpart E and Part 27 of the Federal Communication Commission's rules.

The objective is to determine the Compliant of 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.

Related Submittal(s)/Grant(s)

No related submittal(s)/grant(s).

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-Part 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

Applicable Standards: TIA/EIA 603-D.

All radiated and conducted emissions measurements were performed at Bay Area Compliant Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	5.91dB
	1GHz~6GHz	4.68dB
	6GHz~18GHz	4.92dB
	18GHz~40GHz	5.21dB
Occupied Bandwidth		0.5kHz
Temperature		1.0°C
Humidity		6%

Test Facility

The test site used by Bay Area Compliant Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliant Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA/EIA-603-D.

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

Channel List

Mode		Channel		Frequency (MHz)
GSM 850	Low	128		824.2
	Middle	190		836.6
	High	251		848.8
PCS 1900	Low	512		1850.2
	Middle	661		1880.0
	High	810		1909.8
WCDMA Band II	Low	9262		1852.4
	Middle	9400		1880.0
	High	9538		1907.6
WCDMA Band V	Low	4132		826.4
	Middle	4183		836.6
	High	4233		846.6
LTE Band 2	1.4M	Low	18607	1850.7
		Middle	18900	1880.0
		High	19193	1909.3
	3M	Low	18615	1851.5
		Middle	18900	1880.0
		High	19185	1908.5
	5M	Low	18625	1852.5
		Middle	18900	1880.0
		High	19175	1907.5
	10M	Low	18650	1855.0
		Middle	18900	1880.0
		High	19150	1905.0
	15M	Low	18675	1857.5
		Middle	18900	1880.0
		High	19125	1902.5
	20M	Low	18700	1860.0
		Middle	18900	1880.0
		High	19100	1900.0

Mode		Channel		Frequency (MHz)
LTE Band 4	1.4M	Low	19957	1710.7
		Middle	20175	1732.5
		High	20393	1754.3
	3M	Low	19965	1711.5
		Middle	20175	1732.5
		High	20385	1753.5
	5M	Low	19975	1712.5
		Middle	20175	1732.5
		High	20375	1752.5
	10M	Low	20000	1715.0
		Middle	20175	1732.5
		High	20350	1750.0
	15M	Low	20025	1717.5
		Middle	20175	1732.5
		High	20325	1747.5
20M	Low	20050	1720.0	
	Middle	20175	1732.5	
	High	20300	1745.0	
LTE Band 5	1.4M	Low	20407	824.7
		Middle	20525	836.5
		High	20643	848.3
	3M	Low	20415	825.5
		Middle	20525	836.5
		High	20635	847.5
	5M	Low	20425	826.5
		Middle	20525	836.5
		High	20625	846.5
	10M	Low	20450	829.0
		Middle	20525	836.5
		High	20600	844.0

Equipment Modifications

No modifications were made to the EUT.

Support Equipment List and Details

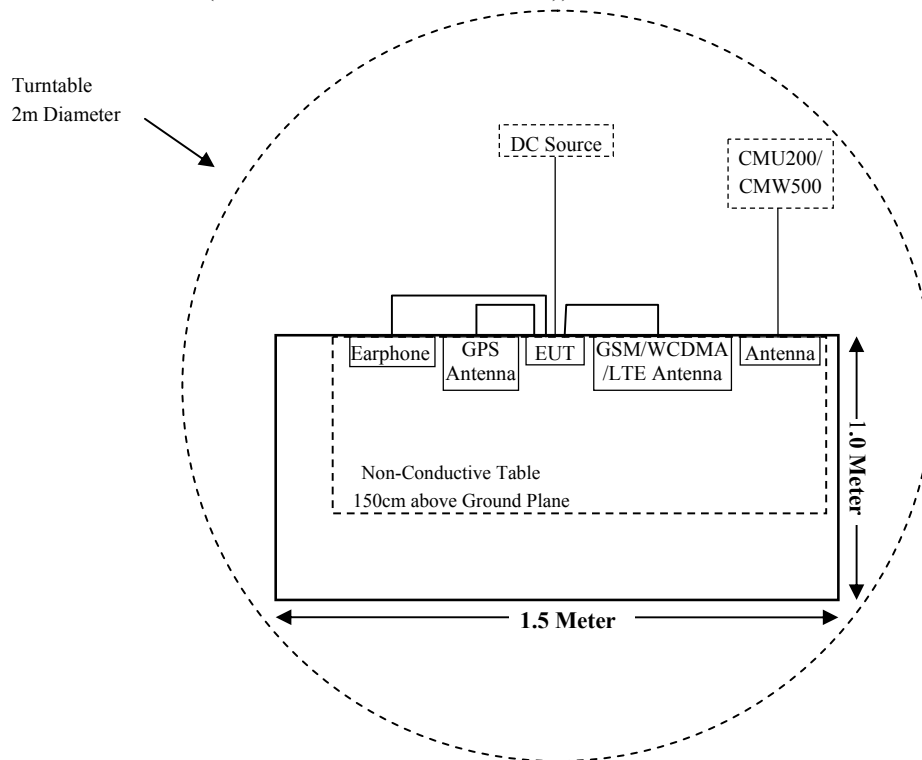
Manufacturer	Description	Model	Serial Number
Waylens Inc.	Antenna	/	/
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	110605
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	104478
/	Earphone	/	/

External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

For Radiated Emissions (Below 1GHz & Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 & §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliant
§2.1046; § 22.913 (a); § 24.232 (c); § 27.50 (d)	RF Output Power	Compliant
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; § 22.905; § 22.917; § 24.238	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 (h)	Spurious Radiated Emissions	Compliant
§ 22.917 (a); § 24.238 (a); §27.53 (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 (Chamber 1#)					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2019-11-30	2020-11-29
HP	Signal Generator	HP 8341B	2624A00116	2019-11-30	2020-11-29
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2019-12-26	2022-12-25
Sunol Sciences	Bilog antenna	JB3	A060217	2017-08-04	2020-08-03
Sonoma Instrument	Pre-amplifier	310N	171205	2019-08-14	2020-08-13
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-8	008	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2019-08-15	2020-08-14
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	110605	2019-11-30	2020-11-29
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	104478	2019-07-21	2020-07-20
Radiated Emission Test (Chamber 2#)					
HP	Signal Generator	HP 8341B	2624A00116	2019-11-30	2020-11-29
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2019-08-27	2020-08-26
ETS-LINDGREN	Horn Antenna	3115	9311-4159	2017-07-15	2020-07-14
ETS-LINDGREN	Horn Antenna	3115	6229	2019-12-12	2022-12-11
ETS-LINDGREN	Horn Antenna	3116	00084159	2019-12-12	2022-12-11
ETS-LINDGREN	Horn Antenna	3116	2516	2020-01-17	2023-01-16
Mini-Circuits	Amplifier	ZVA-183W-S+	220701818	2019-05-20	2020-05-19
EM Electronics Corporation	Amplifier	EM18G40G	060726	2019-03-22	2020-03-21
EM Electronics Corporation	Amplifier	EM18G40G	060726	2020-03-22	2021-03-21
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-16	016	2019-08-15	2020-08-14
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	110605	2019-11-30	2020-11-29
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	104478	2019-07-21	2020-07-20

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2019-11-30	2020-11-29
Rohde & Schwarz	EMI Test Receiver	ESIB26	100146	2019-11-30	2020-11-29
Narda	Attenuator	10dB	010	2019-08-15	2020-08-14
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	110605	2019-11-30	2020-11-29
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	104478	2019-07-21	2020-07-20
Mini-Circuits	Power splitter	ZFRSC-14-S+	SF019411452	2019-11-10	2020-11-09
BACL	Temperature & Humidity Chamber	BTH-150	30023	2019-10-10	2020-10-09
EAST	Regulated DC Power Supply	MCH-303D-II	14070562	2019-10-10	2020-10-09
Rodefend	RF Cable	Rodefend C01	C01	Each Time	/

* **Statement of Traceability:** Bay Area Compliant Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1307 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission’s guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data (worst case):

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
GSM850 (GPRS/EGPRS)	824.2	2.00	1.58	27.00	501.19	20	0.1580	0.55
PCS1900 (GPRS/EGPRS)	1850.2	2.00	1.58	23.50	223.87	20	0.0706	1.00
WCDMA Band II	1852.4	2.00	1.58	24.00	251.19	20	0.0792	1.00
WCDMA Band V	826.4	2.00	1.58	24.00	251.19	20	0.0792	0.55
LTE B2	1850.7	2.00	1.58	23.50	223.87	20	0.0706	1.00
LTE B4	1710.7	2.00	1.58	23.50	223.87	20	0.0706	1.00
LTE B5	824.7	2.00	1.58	24.50	281.84	20	0.0889	0.55

Note 1:

GSM850: Tune-up maximum output power with 4 slots is 30.00 dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 27.00dBm.

PCS1900: Tune-up maximum output power with 4 slots is 26.50 dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 23.50 dBm.

Number of Time slot	1	2	3	4
Duty Cycle	1:8	1:4	1:2.66	1:2
Time based Ave. power compared to slotted Ave. power	-9 dB	-6 dB	-4.26 dB	-3 dB

Result: The device meet FCC MPE at 20 cm distance.

FCC §2.1047 - MODULATION CHARACTERISTIC

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

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

Applicable Standards

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts (38.45dBm).

According to FCC §2.1046 and §24.232 (c), mobile and portable stations are limited to 2 watts (33dBm) EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

According to §27.50(d), the maximum EIRP must not exceed 1Watts (30dBm) for 1710-1755MHz.

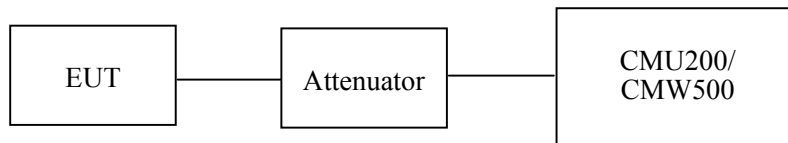
According to §27.50(h) (2), Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

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

Test Procedure

Conducted method:

The RF output of the transmitter was connected to the CMU200/CMW500 through sufficient attenuation.



Radiated Output Power:

The measurements procedures specified in ANSI/TIA-603-D were applied.

- a) Connect the equipment as illustrated. Mount the equipment with the manufacturer specified antenna in a vertical orientation on a manufacturer specified mounting surface located on a non-conducting rotating platform of a RF anechoic chamber (preferred) or a standard radiation site.
- b) Key the transmitter, then rotate the EUT 360o azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading at each angular increment. (Note: several batteries may be needed to offset the effect of battery voltage droop, which should not exceed 5% of the manufactured specified battery voltage during transmission).
- c) Replace the transmitter under test with a vertically polarized half-wave dipole (or an antenna whose gain is known relative to an ideal half-wave dipole). The center of the antenna should be at the same location as the center of the antenna under test.
- d) Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS. If a standard radiation test site is used,raise and lower the test antenna to obtain a maximum reading. $LOSS = \text{Generator Output Power (dBm)} - \text{Analyzer reading (dBm)}$

e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation:

$$\text{ERP (dBm)} = \text{LVL (dBm)} + \text{LOSS (dB)}$$

f) The maximum ERP is the maximum value determined in the preceding step.

(Note: Effective Isotropic Radiated Power (EIRP) can be computed using the following:

$$\text{EIRP (dBm)} = \text{ERP (dBm)} + 2.15 \text{ (dB)}$$

Test Data

Environmental Conditions

Temperature:	23.2 °C
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

The testing was performed by CK Huang on 2020-03-19.

Conducted Power:

GSM 850 Band

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	
GPRS	128	824.2	33.12	32.32	30.15	29.94	38.45
	190	836.6	33.21	32.90	30.22	29.95	38.45
	251	848.8	33.11	32.46	30.24	29.34	38.45

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	
EGPRS	128	824.2	26.74	25.97	23.96	21.21	38.45
	190	836.6	26.84	25.54	23.86	21.34	38.45
	251	848.8	26.32	25.78	23.79	21.11	38.45

WCDMA Band V

Mode	Test Condition	Test Mode	3GPP Sub Test	Average Output Power (dBm)		
				Low Frequency	Middle Frequency	High Frequency
WCDMA (Band V)	Normal	Rel 99	1	23.42	23.78	23.86
		HSDPA	1	22.01	22.16	22.24
			2	21.55	22.03	22.03
			3	22.15	22.11	22.36
			4	22.27	22.08	21.80
		HSUPA	1	21.71	22.07	21.70
			2	22.04	22.14	22.12
			3	21.82	22.12	22.07
			4	22.32	22.17	22.42
			5	22.22	22.06	21.69
		HSPA+	1	22.16	22.16	22.27

PCS 1900 Band

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	
GPRS	512	1850.2	29.21	28.24	27.36	26.12	33
	661	1880.0	29.12	28.14	27.28	26.24	33
	810	1909.8	29.03	28.24	27.40	26.22	33

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	
EGPRS	512	1850.2	26.33	25.21	24.12	22.34	33
	661	1880.0	26.18	25.13	24.31	22.61	33
	810	1909.8	25.98	24.93	23.48	22.26	33

WCDMA Band II

Mode	Test Condition	Test Mode	3GPP Sub Test	Average Output Power (dBm)		
				Low Frequency	Middle Frequency	High Frequency
WCDMA (Band II)	Normal	Rel 99	1	23.16	23.76	23.99
		HSDPA	1	22.69	22.53	22.79
			2	22.63	22.64	22.45
			3	22.75	22.59	22.94
			4	22.85	22.47	22.36
		HSUPA	1	22.76	22.51	22.39
			2	22.86	22.43	22.53
			3	22.92	22.69	22.41
			4	22.78	22.76	23.12
			5	22.45	22.77	23.15
		HSPA+	1	23.01	22.68	22.56

Maximum Output Power:

LTE Band 2

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
1.4M	QPSK	1#0	21.73	21.41	21.33
		1#3	22.64	22.40	21.73
		1#5	22.14	21.96	21.65
		3#0	22.05	22.12	21.83
		3#1	21.99	21.94	22.04
		3#3	22.21	22.25	22.34
		6#0	22.60	21.85	22.35
	16-QAM	1#0	22.68	21.80	21.82
		1#3	22.65	21.47	21.66
		1#5	21.77	21.78	22.21
		3#0	22.14	21.90	21.44
		3#1	21.80	22.24	21.90
		3#3	21.98	22.40	22.45
		6#0	21.82	21.82	21.59
3M	QPSK	1#0	21.74	21.51	21.41
		1#7	22.72	21.67	21.70
		1#14	22.30	22.49	21.61
		8#0	22.57	21.57	21.44
		8#4	21.84	22.50	22.04
		8#7	22.48	22.21	21.66
		15#0	22.37	22.25	22.32
	16-QAM	1#0	21.83	22.19	21.92
		1#7	22.41	22.12	21.95
		1#14	22.60	22.26	22.10
		8#0	21.91	21.68	21.89
		8#4	22.08	22.15	21.79
		8#7	22.53	22.50	21.42
		15#0	22.22	22.30	22.28

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
5M	QPSK	1#0	21.83	21.40	21.45
		1#12	22.27	21.40	21.48
		1#24	21.92	22.10	21.91
		12#0	22.69	21.74	22.15
		12#6	22.47	21.85	21.70
		12#11	22.07	22.26	22.08
		25#0	22.26	21.74	22.22
	16-QAM	1#0	21.96	21.48	22.39
		1#12	22.57	22.19	22.41
		1#24	22.62	21.54	22.03
		12#0	22.28	21.51	21.93
		12#6	22.28	21.82	22.26
		12#11	22.13	22.15	22.17
		25#0	21.93	21.61	22.37
10M	QPSK	1#0	21.87	21.28	21.65
		1#24	22.83	21.76	22.46
		1#49	22.38	22.04	22.28
		25#0	22.59	21.77	22.55
		25#12	22.27	22.26	22.46
		25#24	22.68	22.00	22.49
		50#0	22.79	21.57	21.90
	16-QAM	1#0	22.37	21.54	22.26
		1#24	22.32	21.72	21.92
		1#49	22.38	21.71	22.60
		25#0	22.59	21.65	22.26
		25#12	22.52	21.48	22.02
		25#24	22.14	21.94	21.70
		50#0	22.05	21.91	22.01

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
15M	QPSK	1#0	22.15	22.17	21.74
		1#37	22.84	22.98	22.19
		1#74	22.85	22.38	22.69
		36#0	22.37	23.01	22.04
		36#17	23.14	22.30	21.96
		36#35	22.94	22.62	22.19
		75#0	22.49	22.20	21.81
	16-QAM	1#0	22.84	22.62	21.80
		1#37	23.04	22.71	22.34
		1#74	22.64	23.16	22.51
		36#0	22.42	22.67	21.76
		36#17	23.07	22.81	21.84
		36#35	22.55	22.47	22.50
		75#0	22.77	22.34	22.66
20M	QPSK	1#0	22.52	22.26	21.92
		1#49	22.24	23.07	22.39
		1#99	22.69	23.05	22.28
		50#0	22.65	23.13	22.21
		50#24	22.89	22.35	21.80
		50#49	22.97	23.01	22.74
		100#0	22.50	23.08	21.77
	16-QAM	1#0	22.83	23.02	22.04
		1#49	22.56	22.17	22.42
		1#99	23.11	22.90	22.56
		50#0	22.36	22.55	22.08
		50#24	22.33	22.67	22.57
		50#49	22.48	22.54	21.81
		100#0	22.37	22.26	22.65

LTE Band 4

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
1.4M	QPSK	1#0	21.82	21.69	22.05
		1#3	21.99	21.96	22.43
		1#5	22.33	21.90	22.88
		3#0	22.34	22.02	23.04
		3#1	22.62	22.58	22.65
		3#3	21.96	22.22	22.37
		6#0	22.16	22.62	22.81
	16-QAM	1#0	22.40	22.38	22.42
		1#3	22.45	22.56	22.96
		1#5	21.99	22.43	23.03
		3#0	22.52	22.02	22.92
		3#1	22.43	22.31	22.16
		3#3	22.36	21.87	22.34
		6#0	22.45	21.71	22.34
3M	QPSK	1#0	22.07	21.89	22.82
		1#7	22.51	22.56	22.08
		1#14	22.74	22.01	22.42
		8#0	22.13	22.59	22.77
		8#4	22.38	21.90	22.75
		8#7	22.08	22.44	22.89
		15#0	22.49	22.40	22.40
	16-QAM	1#0	22.06	21.84	22.45
		1#7	22.74	21.71	22.29
		1#14	22.10	22.46	22.30
		8#0	22.11	22.01	22.20
		8#4	21.93	22.54	22.82
		8#7	22.29	22.41	22.60
		15#0	21.94	21.69	22.22

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
5M	QPSK	1#0	21.72	21.78	21.96
		1#12	21.97	22.54	22.04
		1#24	22.59	21.85	22.62
		12#0	22.27	22.72	22.21
		12#6	22.61	22.07	22.14
		12#11	22.22	22.30	22.95
		25#0	22.11	22.58	22.41
	16-QAM	1#0	21.80	22.39	22.59
		1#12	22.23	22.03	22.13
		1#24	21.82	22.14	22.09
		12#0	22.36	22.49	22.33
		12#6	22.19	22.18	22.57
		12#11	22.52	22.47	22.68
		25#0	22.56	22.40	22.62
10M	QPSK	1#0	22.68	21.89	22.24
		1#24	21.77	21.82	22.53
		1#49	22.36	22.64	22.90
		25#0	22.18	22.67	22.05
		25#12	22.58	21.82	22.71
		25#24	22.13	22.73	22.76
		50#0	22.36	22.01	22.46
	16-QAM	1#0	22.35	22.13	22.77
		1#24	22.38	22.69	22.38
		1#49	21.92	22.20	22.58
		25#0	21.96	22.62	22.63
		25#12	22.30	22.71	22.60
		25#24	22.34	22.27	22.09
		50#0	22.57	22.25	22.37

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
15M	QPSK	1#0	21.76	21.61	21.88
		1#37	22.25	21.90	22.29
		1#74	22.62	22.37	22.42
		36#0	22.68	21.73	22.14
		36#17	22.62	22.21	22.79
		36#35	22.28	22.33	22.21
		75#0	22.19	22.47	21.98
	16-QAM	1#0	22.59	22.40	22.45
		1#37	21.94	21.91	21.97
		1#74	22.28	21.85	22.14
		36#0	22.46	22.31	22.25
		36#17	22.58	21.80	22.42
		36#35	22.53	22.09	22.13
		75#0	22.39	21.88	22.53
20M	QPSK	1#0	22.33	21.71	22.63
		1#49	22.31	22.10	22.39
		1#99	22.22	21.73	22.55
		50#0	22.12	22.43	22.28
		50#24	22.48	22.41	22.78
		50#49	22.43	21.94	22.10
		100#0	21.95	21.72	22.25
	16-QAM	1#0	21.88	21.98	22.25
		1#49	22.50	22.18	22.57
		1#99	22.14	22.06	21.89
		50#0	22.32	21.95	22.19
		50#24	22.33	22.59	22.13
		50#49	22.07	22.38	22.42
		100#0	22.71	21.86	22.14

LTE Band 5

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
1.4M	QPSK	1#0	23.33	23.26	23.12
		1#3	23.69	23.73	24.01
		1#5	23.71	23.94	23.98
		3#0	23.91	23.86	23.19
		3#1	24.02	24.15	23.27
		3#3	23.93	24.16	24.11
		6#0	23.91	23.54	23.58
	16-QAM	1#0	24.14	24.25	23.83
		1#3	23.67	24.09	24.01
		1#5	23.46	23.38	23.75
		3#0	23.88	23.49	23.90
		3#1	23.64	23.60	23.81
		3#3	23.97	24.05	23.38
		6#0	23.61	24.16	23.78
3M	QPSK	1#0	24.00	23.49	23.98
		1#7	23.58	23.87	23.45
		1#14	24.14	23.74	23.50
		8#0	23.86	23.81	23.21
		8#4	23.90	23.28	23.49
		8#7	24.30	24.05	23.44
		15#0	24.06	23.39	23.13
	16-QAM	1#0	23.97	23.35	24.05
		1#7	23.69	23.91	23.73
		1#14	23.98	23.48	23.48
		8#0	23.41	24.25	23.29
		8#4	24.19	23.66	23.56
		8#7	23.33	23.74	23.36
		15#0	23.68	24.15	23.90

Test Bandwidth	Test Modulation	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
5M	QPSK	1#0	23.51	23.26	23.32
		1#12	23.93	23.42	23.37
		1#24	23.84	23.35	23.46
		12#0	24.38	24.24	23.72
		12#6	23.94	23.34	23.57
		12#11	24.01	23.42	23.79
		25#0	24.00	23.42	23.97
	16-QAM	1#0	23.84	23.61	24.17
		1#12	23.72	23.37	24.15
		1#24	23.58	23.95	23.43
		12#0	24.42	23.32	23.68
		12#6	24.05	23.56	23.96
		12#11	24.22	23.96	23.37
		25#0	23.75	23.69	23.58
10M	QPSK	1#0	23.72	23.56	23.40
		1#24	23.73	23.70	23.98
		1#49	24.16	23.50	23.64
		25#0	23.91	23.89	23.34
		25#12	24.34	23.86	24.24
		25#24	24.16	24.09	23.73
		50#0	24.35	23.82	23.65
	16-QAM	1#0	24.24	23.28	23.73
		1#24	23.72	23.46	24.12
		1#49	23.71	23.39	23.38
		25#0	23.87	23.68	24.09
		25#12	24.42	23.88	23.51
		25#24	23.76	23.45	23.72
		50#0	23.77	24.18	24.17

Peak-to-average ratio (PAR):

GSM 850 Band

Mode	Channel	PAR (dB)	Limit (dB)
GPRS	Low	2.79	13
	Middle	2.87	13
	High	2.85	13

Mode	Channel	PAR (dB)	Limit (dB)
EGPRS	Low	2.83	13
	Middle	2.86	13
	High	2.93	13

PCS 1900 Band

Mode	Channel	PAR (dB)	Limit (dB)
GPRS	Low	2.77	13
	Middle	2.71	13
	High	2.79	13

Mode	Channel	PAR (dB)	Limit (dB)
EGPRS	Low	2.67	13
	Middle	2.58	13
	High	2.70	13

WCDMA Band V

Mode	Channel	PAR (dB)	Limit (dB)
WCDMA (Rel99)	Low	3.31	≤ 13
	Middle	3.26	≤ 13
	High	3.31	≤ 13
WCDMA (HSDPA)	Low	2.73	≤ 13
	Middle	2.83	≤ 13
	High	2.83	≤ 13
WCDMA (HSUPA)	Low	2.83	≤ 13
	Middle	2.75	≤ 13
	High	2.79	≤ 13
WCDMA (HSPA+)	Low	2.59	≤ 13
	Middle	2.52	≤ 13
	High	2.59	≤ 13

WCDMA Band II

Mode	Channel	PAR (dB)	Limit (dB)
WCDMA (Rel99)	Low	2.72	≤ 13
	Middle	2.67	≤ 13
	High	2.68	≤ 13
WCDMA (HSDPA)	Low	2.57	≤ 13
	Middle	2.55	≤ 13
	High	2.56	≤ 13
WCDMA (HSUPA)	Low	2.61	≤ 13
	Middle	2.61	≤ 13
	High	2.6	≤ 13
WCDMA (HSPA+)	Low	2.52	≤ 13
	Middle	2.43	≤ 13
	High	2.36	≤ 13

LTE Band 2

Test Modulation		Test Bandwidth	Low Channel (dB)	Middle Channel (dB)	High Channel (dB)	Limit (dB)
QPSK	1 RB	20M	3.43	3.55	3.60	13
	100 RB		5.76	5.71	5.84	13
16-QAM	1 RB	20M	4.77	4.70	7.21	13
	100 RB		6.52	6.34	6.87	13

LTE Band 4

Test Modulation		Test Bandwidth	Low Channel (dB)	Middle Channel (dB)	High Channel (dB)	Limit(dB)
QPSK	1 RB	20M	3.57	3.73	3.62	13
	100 RB		5.63	5.79	5.59	13
16-QAM	1 RB	20M	4.43	4.61	4.53	13
	100 RB		6.51	6.59	6.59	13

LTE Band 5

Test Modulation		Test Bandwidth	Low Channel (dB)	Middle Channel (dB)	High Channel (dB)	Limit(dB)
QPSK	1 RB	10M	3.37	3.64	3.62	13
	50 RB		5.39	5.58	5.57	13
16-QAM	1 RB	10M	4.61	4.73	4.66	13
	50 RB		6.59	6.83	6.72	13

Radiated Power:

GSM Mode

Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable loss (dB)	Antenna Gain (dBd/dBi)			
GPRS 850, Middle Channel (ERP)										
836.6	98.16	77	200	H	34.50	0.63	-1.10	32.77	38.45	5.68
836.6	97.68	310	157	V	34.02	0.63	-1.10	32.29	38.45	6.16
EGPRS 850, Middle Channel (ERP)										
836.6	93.44	56	152	H	29.78	0.63	-1.1	28.05	38.45	10.40
836.6	93.52	254	175	V	29.86	0.63	-1.1	28.13	38.45	10.32
GPRS 1900, Middle Channel (EIRP)										
1880	94.13	225	198	H	21.00	0.85	8.81	28.96	33	4.04
1880	94.23	350	174	V	21.10	0.85	8.81	29.06	33	3.94
EGPRS 1900, Middle Channel (EIRP)										
1880	89.76	275	163	H	16.63	0.85	8.81	24.59	33	8.41
1880	90.01	300	112	V	16.88	0.85	8.81	24.84	33	8.16

WCDMA Mode

Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable loss (dB)	Antenna Gain (dBd/dBi)			
WCDMA Band V, Middle Channel(ERP)										
836.6	86.48	40	187	H	22.97	0.63	-1.14	21.20	38.45	17.25
836.6	87.39	201	130	V	23.88	0.63	-1.14	22.11	38.45	16.34
WCDMA Band II, Middle Channel(EIRP)										
1880	86.35	211	214	H	14.06	0.85	9.00	22.21	33	10.79
1880	86.19	210	206	V	13.90	0.85	9.00	22.05	33	10.95

EIRP:

LTE Band 2

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Submitted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK 1.4M BW Middle Channel								
1880	H	86.46	13.42	0.85	8.81	21.38	33	11.62
1880	V	86.12	13.08	0.85	8.81	21.04	33	11.96
16-QAM 1.4M BW Middle Channel								
1880	H	86.16	13.12	0.85	8.81	21.08	33	11.92
1880	V	86.23	13.19	0.85	8.81	21.15	33	11.85
QPSK 3M BW Middle Channel								
1880	H	86.34	13.30	0.85	8.81	21.26	33	11.74
1880	V	86.28	13.24	0.85	8.81	21.20	33	11.80
16-QAM 3M BW Middle Channel								
1880	H	86.26	13.22	0.85	8.81	21.18	33	11.82
1880	V	86.48	13.66	0.85	8.81	21.62	33	11.38
QPSK 5M BW Middle Channel								
1880	H	87.16	14.12	0.85	8.81	22.08	33	10.92
1880	V	86.48	13.66	0.85	8.81	21.62	33	11.38
16-QAM 5M BW Middle Channel								
1880	H	87.13	14.09	0.85	8.81	22.05	33	10.95
1880	V	87.43	14.61	0.85	8.81	22.57	33	10.43
QPSK 10M BW Middle Channel								
1880	H	86.72	13.68	0.85	8.81	21.64	33	11.36
1880	V	87.06	14.24	0.85	8.81	22.20	33	10.80
16-QAM 10M BW Middle Channel								
1880	H	87.08	14.04	0.85	8.81	22.00	33	11.00
1880	V	86.59	13.77	0.85	8.81	21.73	33	11.27
QPSK 15M BW Middle Channel								
1880	H	86.48	13.44	0.85	8.81	21.40	33	11.60
1880	V	87.09	14.27	0.85	8.81	22.23	33	10.77
16-QAM 15M BW Middle Channel								
1880	H	86.73	13.69	0.85	8.81	21.65	33	11.35
1880	V	87.19	14.37	0.85	8.81	22.33	33	10.67
QPSK 20M BW Middle Channel								
1880	H	87.07	14.03	0.85	8.81	21.99	33	11.01
1880	V	86.92	14.10	0.85	8.81	22.06	33	10.94
16-QAM 20M BW Middle Channel								
1880	H	87.49	14.45	0.85	8.81	22.41	33	10.59
1880	V	86.89	14.07	0.85	8.81	22.03	33	10.97

LTE Band 4

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Submitted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK 1.4M BW Middle Channel								
1732.5	H	88.96	14.90	0.84	8.57	22.63	30	7.37
1732.5	V	87.42	13.36	0.84	8.57	21.09	30	8.91
16-QAM 1.4M BW Middle Channel								
1732.5	H	88.49	14.43	0.84	8.57	22.16	30	7.84
1732.5	V	87.56	13.50	0.84	8.57	21.23	30	8.77
QPSK 3M BW Middle Channel								
1732.5	H	89.64	15.58	0.84	8.57	23.31	30	6.69
1732.5	V	87.89	13.83	0.84	8.57	21.56	30	8.44
16-QAM 3M BW Middle Channel								
1732.5	H	89.61	15.55	0.84	8.57	23.28	30	6.72
1732.5	V	87.70	13.64	0.84	8.57	21.37	30	8.63
QPSK 5M BW Middle Channel								
1732.5	H	89.51	15.45	0.84	8.57	23.18	30	6.82
1732.5	V	87.46	13.40	0.84	8.57	21.13	30	8.87
16-QAM 5M BW Middle Channel								
1732.5	H	87.71	13.65	0.84	8.57	21.38	30	8.62
1732.5	V	87.16	13.10	0.84	8.57	20.83	30	9.17
QPSK 10M BW Middle Channel								
1732.5	H	89.43	15.37	0.84	8.57	23.10	30	6.90
1732.5	V	87.42	13.36	0.84	8.57	21.09	30	8.91
16-QAM 10M BW Middle Channel								
1732.5	H	89.01	14.95	0.84	8.57	22.68	30	7.32
1732.5	V	87.44	13.38	0.84	8.57	21.11	30	8.89
QPSK 15M BW Middle Channel								
1732.5	H	89.33	15.27	0.84	8.57	23.00	30	7.00
1732.5	V	87.93	13.87	0.84	8.57	21.60	30	8.40
16-QAM 15M BW Middle Channel								
1732.5	H	89.17	15.11	0.84	8.57	22.84	30	7.16
1732.5	V	87.68	13.62	0.84	8.57	21.35	30	8.65
QPSK 20M BW Middle Channel								
1732.5	H	89.18	15.12	0.84	8.57	22.85	30	7.15
1732.5	V	87.39	13.33	0.84	8.57	21.06	30	8.94
16-QAM 20M BW Middle Channel								
1732.5	H	89.03	14.97	0.84	8.57	22.70	30	7.30
1732.5	V	87.46	13.40	0.84	8.57	21.13	30	8.87

LTE Band 5

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Submitted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
QPSK 1.4M BW Middle Channel								
836.5	H	89.87	24.40	0.63	-1.14	22.63	38.45	15.82
836.5	V	90.75	25.28	0.63	-1.14	23.51	38.45	14.94
16-QAM 1.4M BW Middle Channel								
836.5	H	89.76	24.29	0.63	-1.14	22.52	38.45	15.93
836.5	V	90.66	25.19	0.63	-1.14	23.42	38.45	15.03
QPSK 3M BW Middle Channel								
836.5	H	89.63	24.16	0.63	-1.14	22.39	38.45	16.06
836.5	V	90.53	25.06	0.63	-1.14	23.29	38.45	15.16
16-QAM 3M BW Middle Channel								
836.5	H	89.64	24.17	0.63	-1.14	22.40	38.45	16.05
836.5	V	90.39	24.92	0.63	-1.14	23.15	38.45	15.30
QPSK 5M BW Middle Channel								
836.5	H	89.52	24.05	0.63	-1.14	22.28	38.45	16.17
836.5	V	90.22	24.75	0.63	-1.14	22.98	38.45	15.47
16-QAM 5M BW Middle Channel								
836.5	H	89.53	24.06	0.63	-1.14	22.29	38.45	16.16
836.5	V	90.09	24.62	0.63	-1.14	22.85	38.45	15.60
QPSK 10M BW Middle Channel								
836.5	H	89.37	23.90	0.63	-1.14	22.13	38.45	16.32
836.5	V	90.97	25.50	0.63	-1.14	23.73	38.45	14.72
16-QAM 10M BW Middle Channel								
836.5	H	89.25	23.78	0.63	-1.14	22.01	38.45	16.44
836.5	V	90.83	25.36	0.63	-1.14	23.59	38.45	14.86

Note:

All above data were tested without amplifier.

Absolute Level (dBm) = Submitted Level (dBm) - Cable loss (dB) + Antenna Gain (dBd/dBi)

Margin (dB) = Limit (dBm) - Absolute Level (dBm)

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

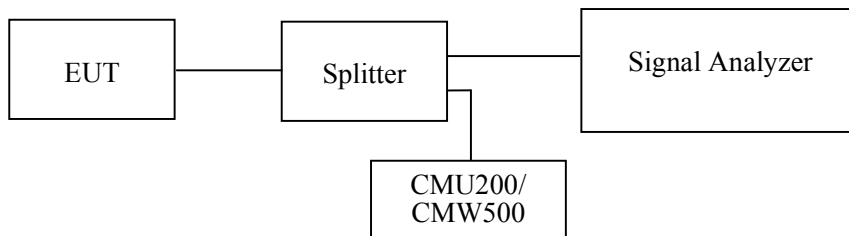
Applicable Standards

FCC 47 §2.1049, §22.917, §22.905, §24.238 and §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 5 kHz (Cellular /PCS) &100 kHz (WCDMA) & 20 kHz/30 kHz/50 kHz/100 kHz/200 kHz (LTE), and the 26 dB & 99% bandwidth was recorded.



Test Data

Environmental Conditions

Temperature:	23.2-23.5 °C
Relative Humidity:	41-53 %
ATM Pressure:	101.1-103.3 kPa

The testing was performed by CK Huang from 2020-03-14 to 2020-03-24.

EUT operation mode: Transmitting

Test Result: Compliant.

GSM 850 Band

Mode	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GPRS (GMSK)	836.6	0.319	0.242
EGPRS (8PSK)	836.6	0.301	0.236

WCDMA Band V

Mode	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
WCDMA (BPSK)	836.6	4.770	4.148
WCDMA (HSDPA)	836.6	4.749	4.148
WCDMA (HSUPA)	836.6	4.729	4.148
WCDMA (HSPA+)	836.6	4.749	4.148

PCS 1900 Band

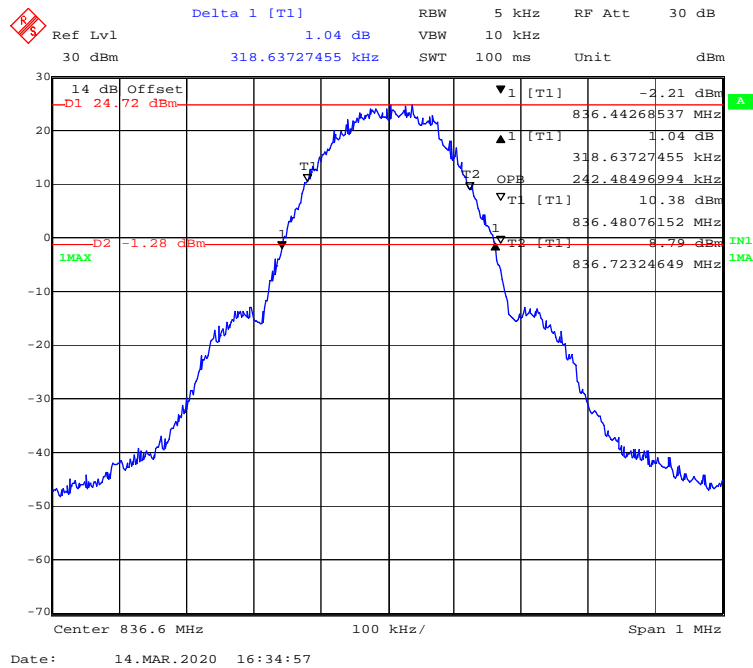
Mode	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GPRS (GMSK)	1880	0.315	0.246
EGPRS (8PSK)	1880	0.317	0.244

WCDMA Band II

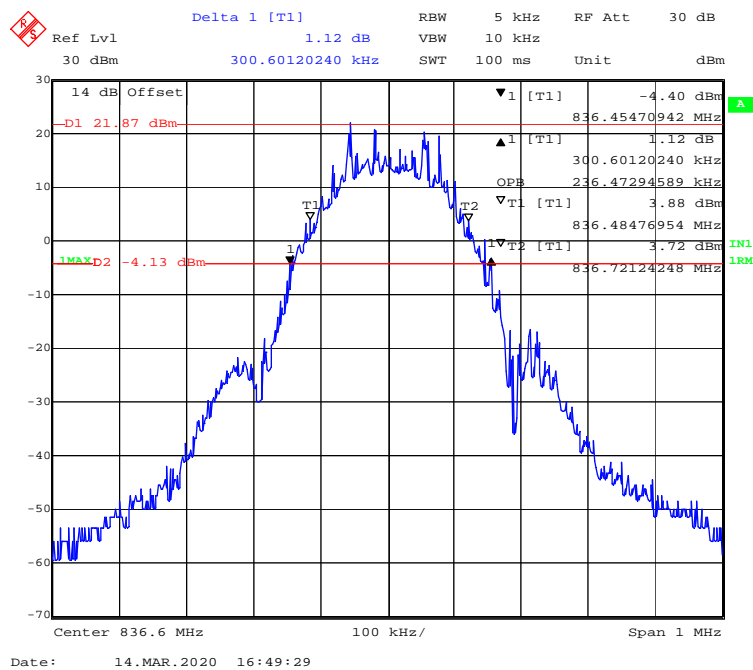
Mode	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
WCDMA (BPSK)	1880	4.749	4.168
WCDMA (HSDPA)	1880	4.749	4.148
WCDMA (HSUPA)	1880	4.749	4.148
WCDMA (HSPA+)	1880	4.749	4.128

GSM 850 Band

99% Occupied & 26 dB Emissions Bandwidth for GPRS (GMSK) Mode

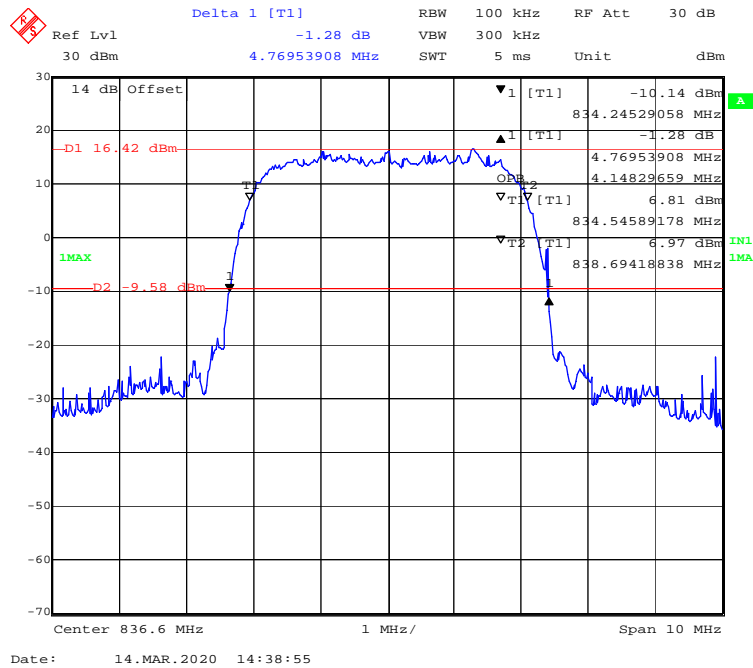


99% Occupied & 26 dB Emissions Bandwidth for EGPRS (8PSK) Mode

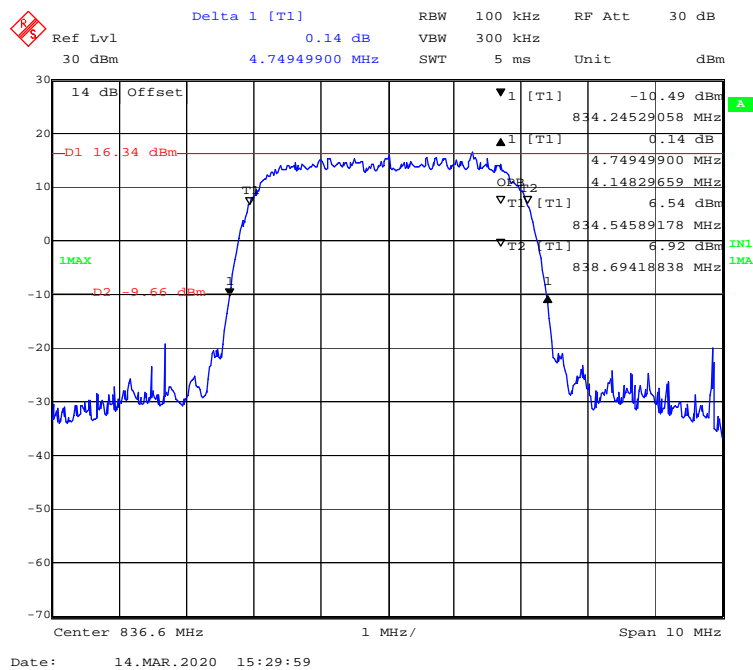


WCDMA Band V

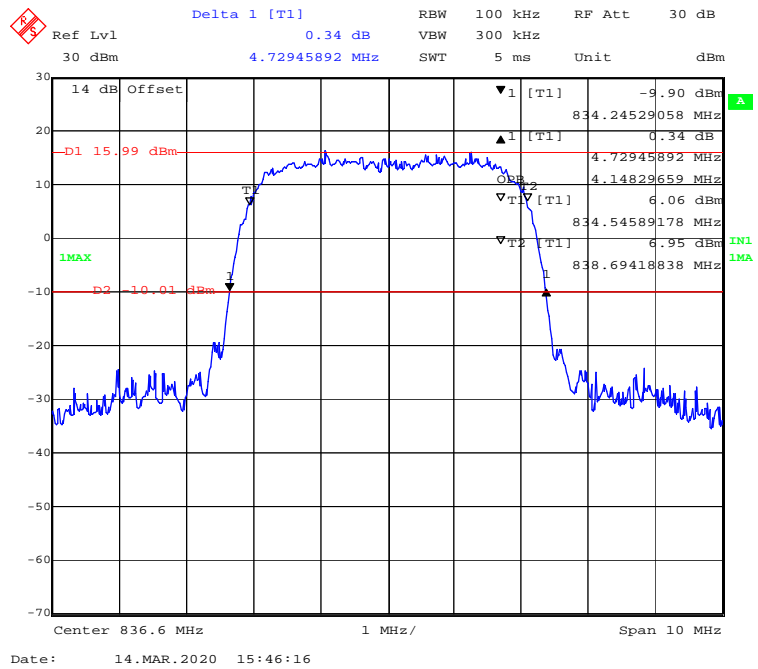
99% Occupied & 26 dB Emissions Bandwidth for WCDMA (Rel 99) Mode



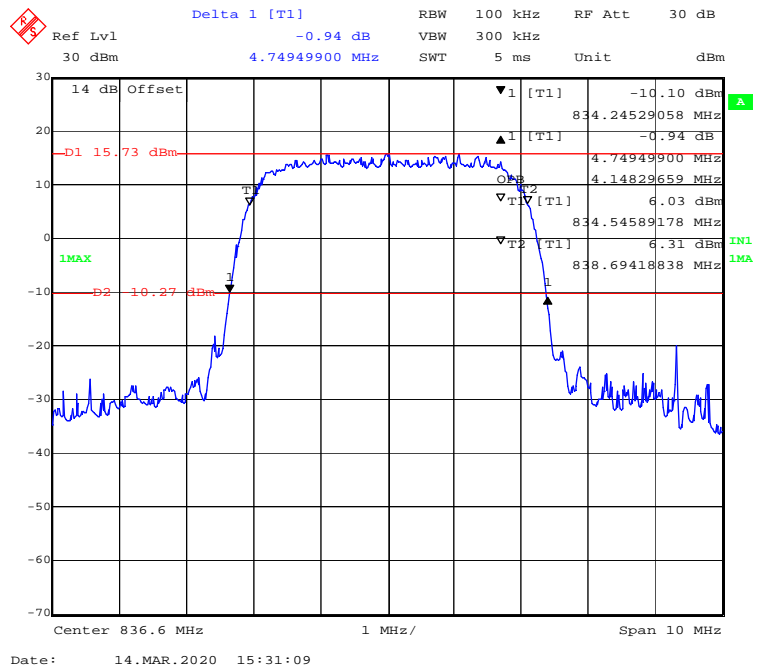
99% Occupied & 26 dB Emissions Bandwidth for WCDMA (HSDPA) Mode



99% Occupied & 26 dB Emissions Bandwidth for WCDMA (HSUPA) Mode

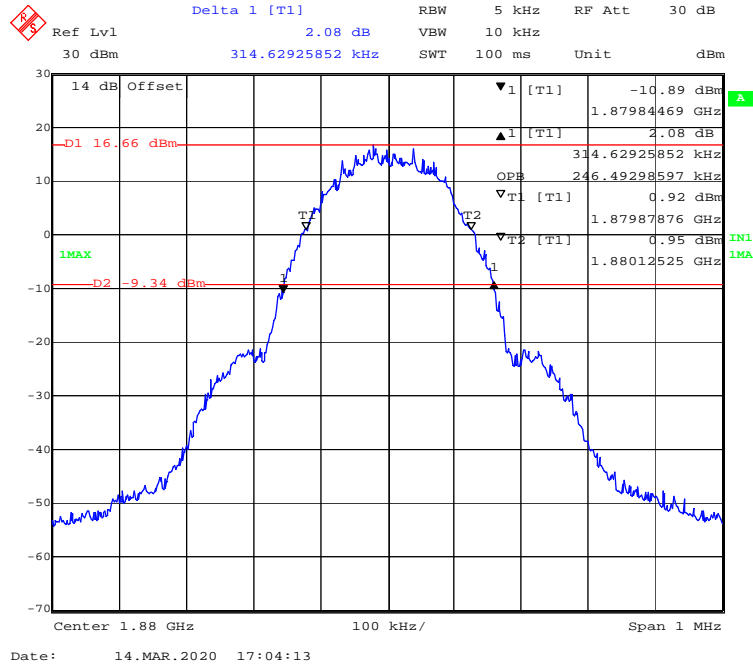


99% Occupied & 26 dB Emissions Bandwidth for WCDMA (HSPA+) Mode

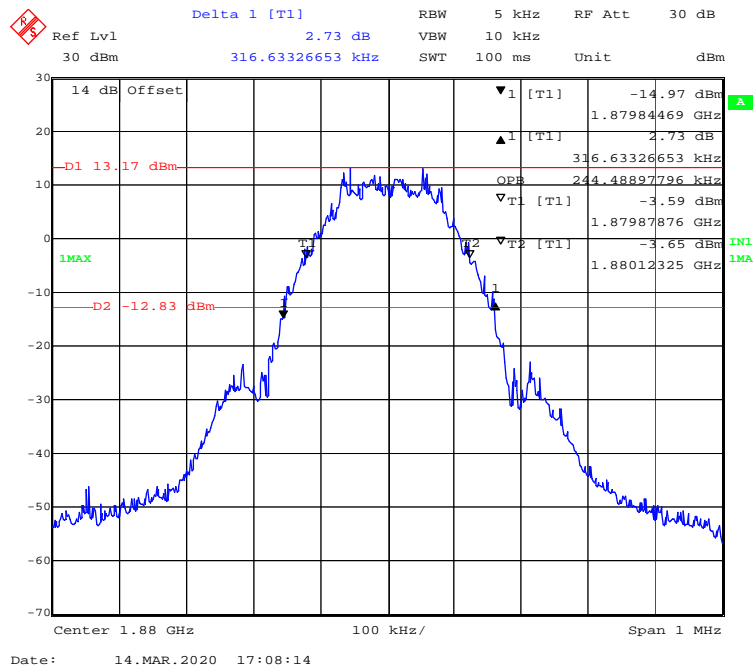


PCS 1900Band

99% Occupied & 26 dB Emissions Bandwidth for GPRS (GMSK) Mode

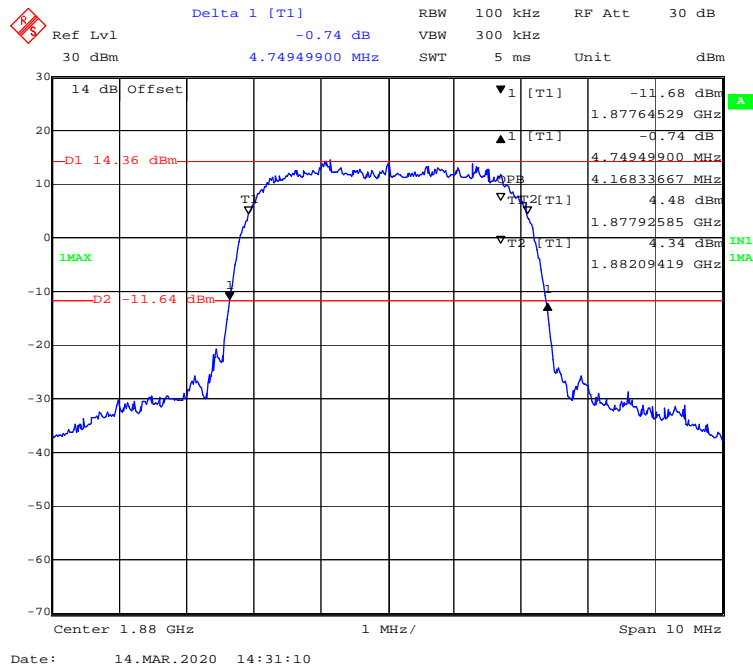


99% Occupied & 26 dB Emissions Bandwidth for EGPRS (8PSK) Mode

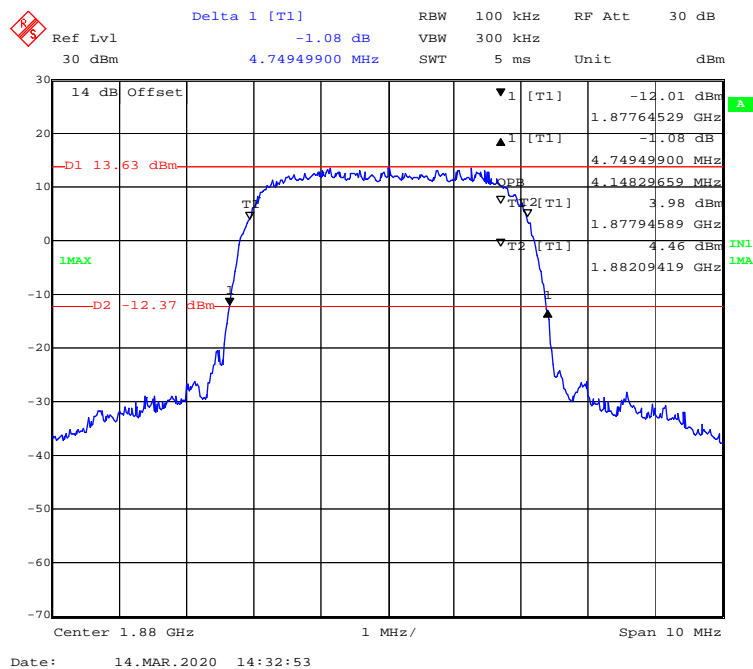


WCDMA Band II

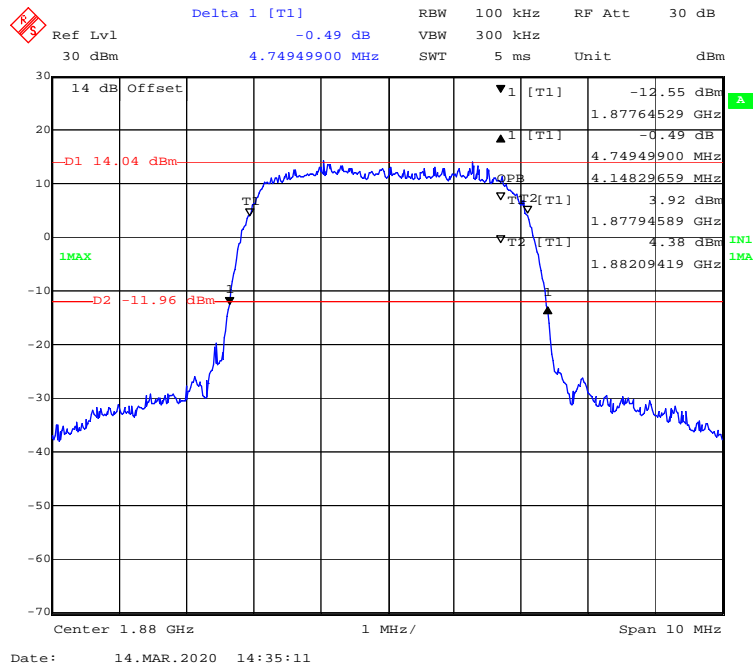
99% Occupied & 26 dB Emissions Bandwidth for WCDMA (Rel 99) Mode



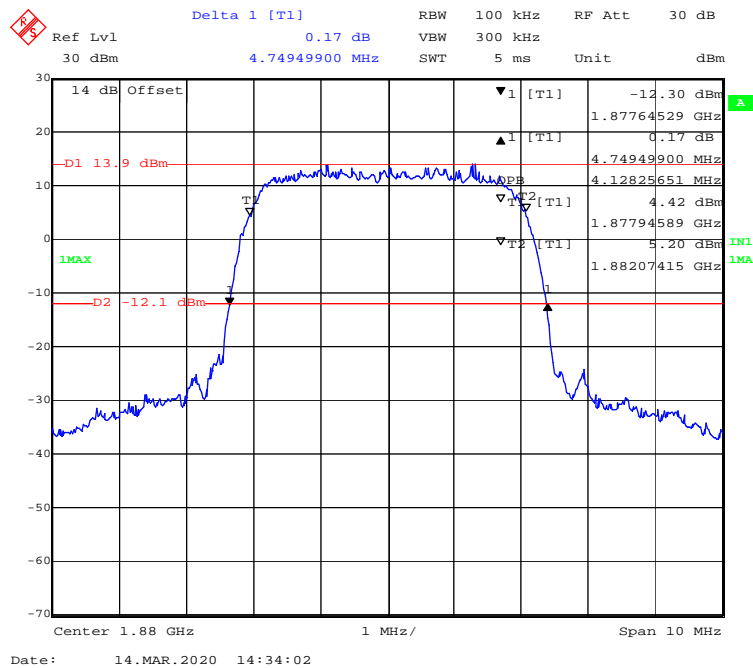
99% Occupied & 26 dB Emissions Bandwidth for WCDMA (HSDPA) Mode



99% Occupied & 26 dB Emissions Bandwidth for WCDMA (HSUPA) Mode



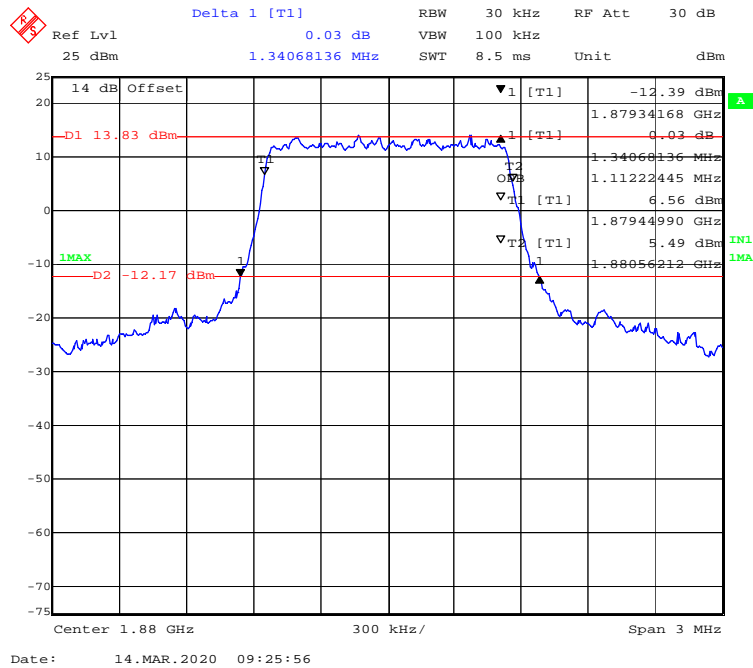
99% Occupied & 26 dB Emissions Bandwidth for WCDMA (HSPA+) Mode



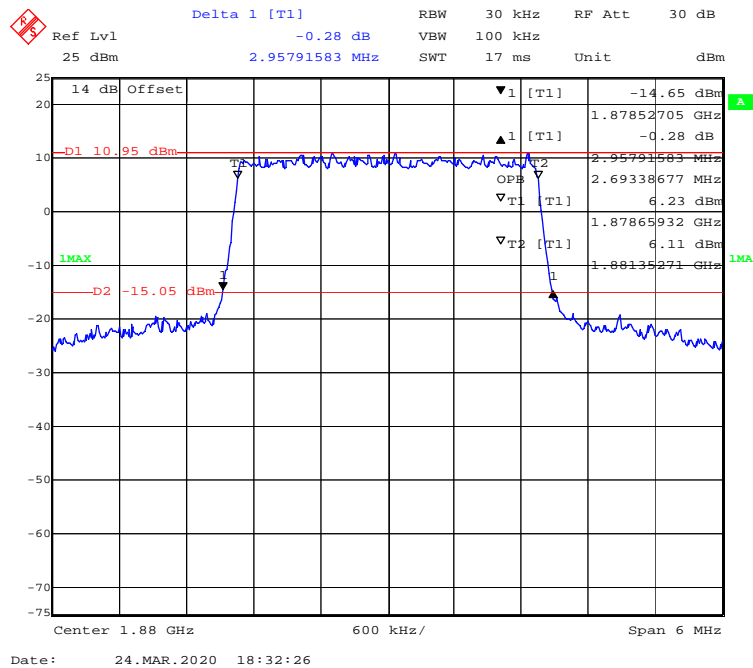
LTE Band 2:

Test Modulation	Test Bandwidth	Test Channel	26 dB Bandwidth	99% Occupied Bandwidth
			MHz	MHz
QPSK	1.4M	Middle	1.341	1.112
	3M		2.958	2.693
	5M		4.970	4.489
	10M		9.820	8.978
	15M		14.669	13.467
	20M		19.319	17.876
16-QAM	1.4M	Middle	1.305	1.094
	3M		2.970	2.705
	5M		4.990	4.489
	10M		9.739	8.938
	15M		14.609	13.407
	20M		19.158	17.956

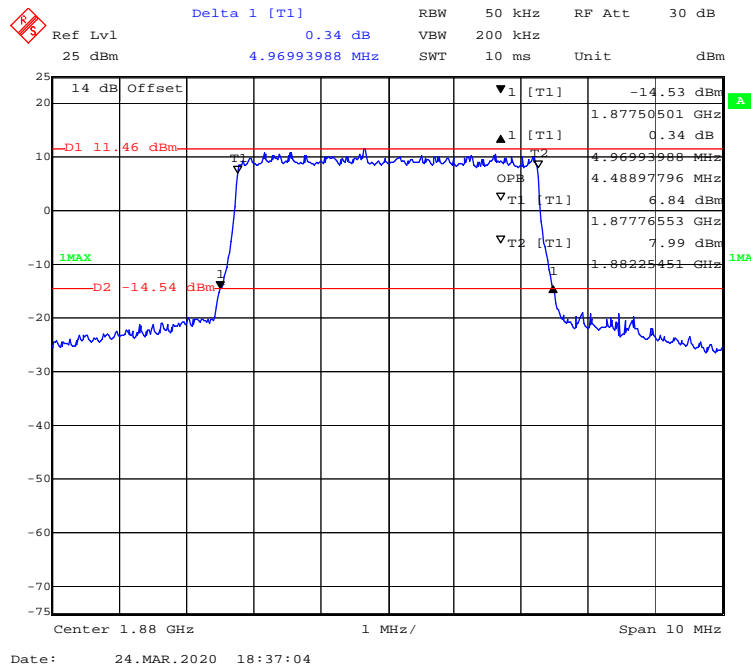
QPSK (1.4 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



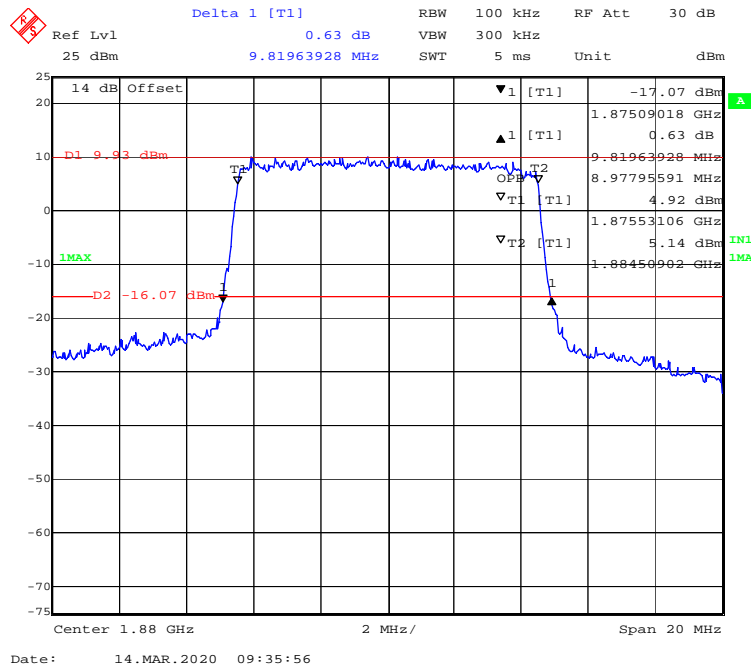
QPSK (3.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



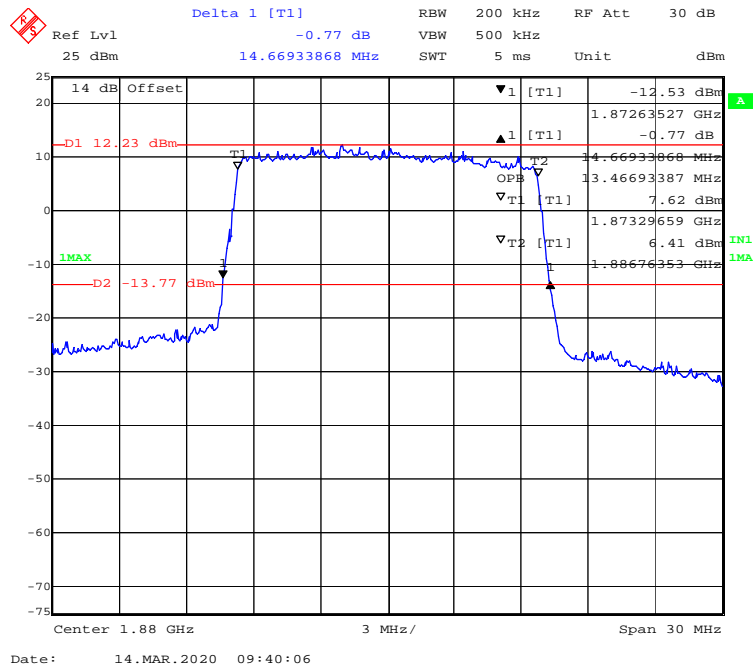
QPSK (5.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



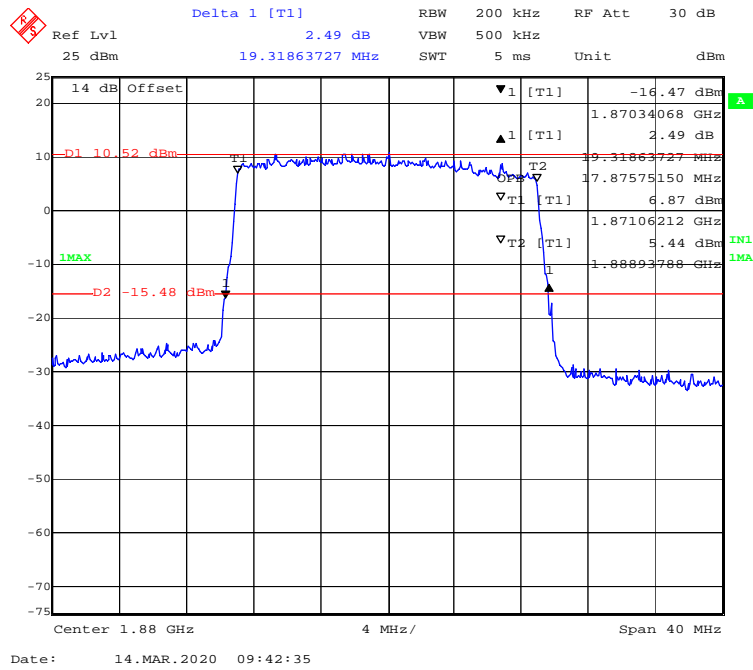
QPSK (10.0MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



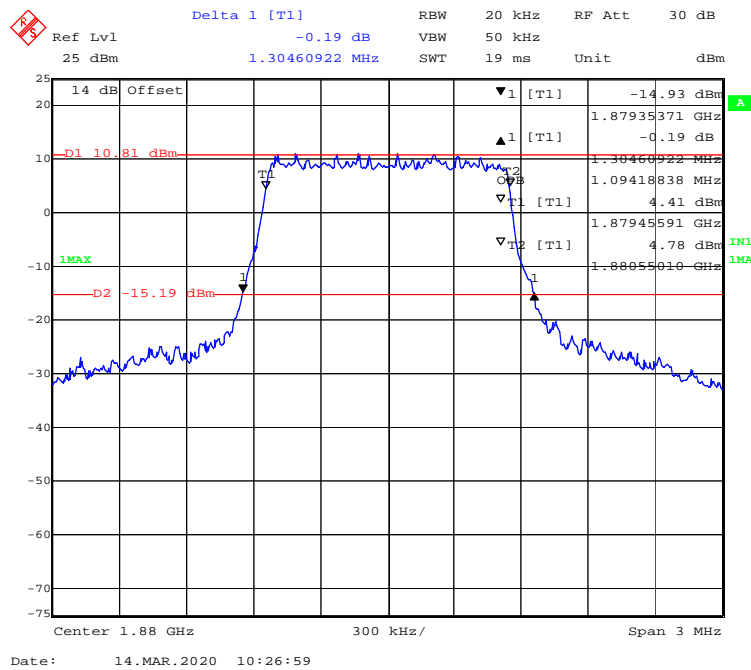
QPSK (15.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



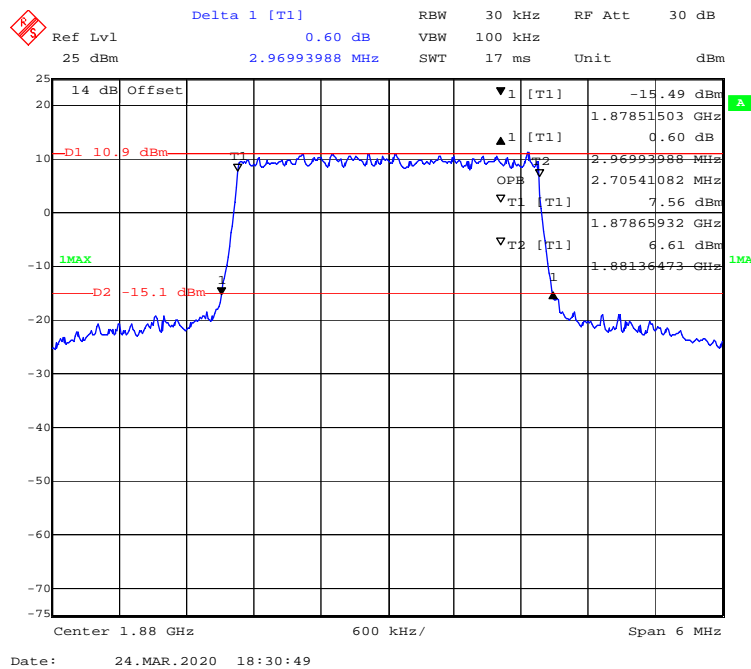
QPSK (20.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



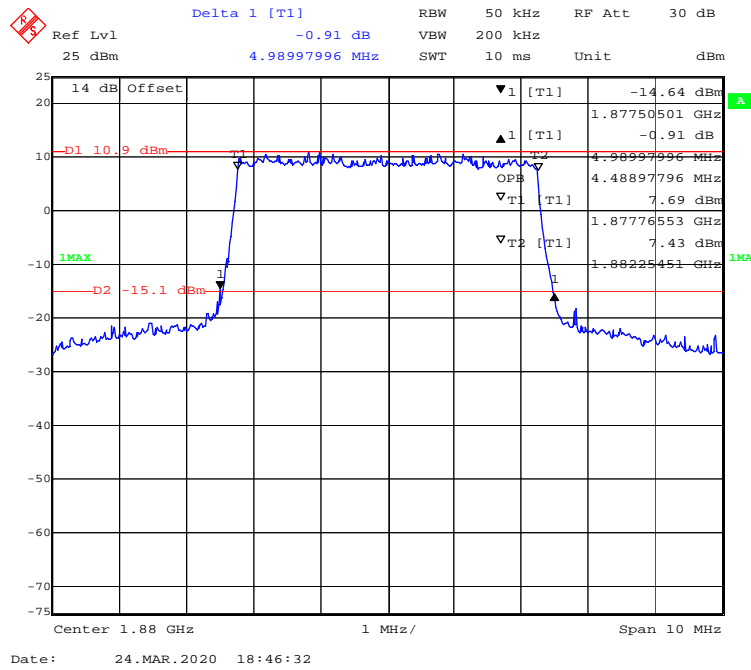
16-QAM (1.4 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



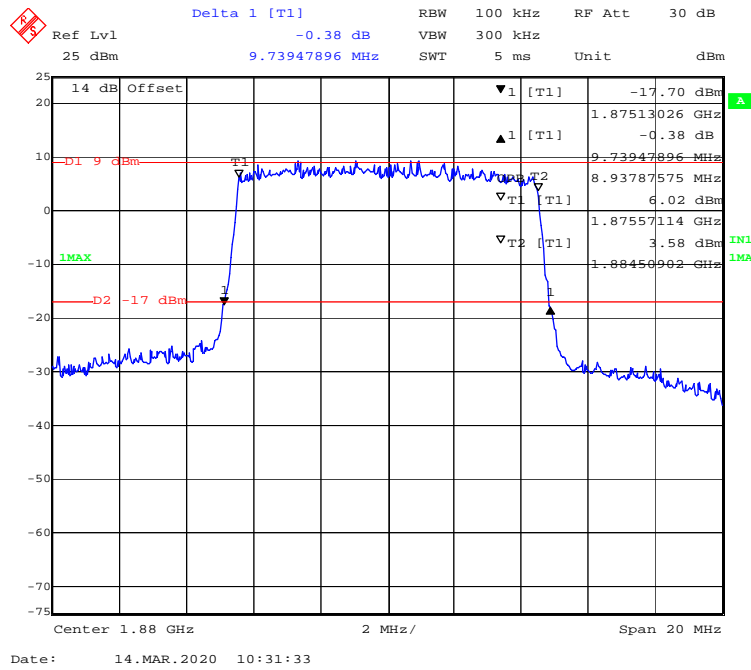
16-QAM (3.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



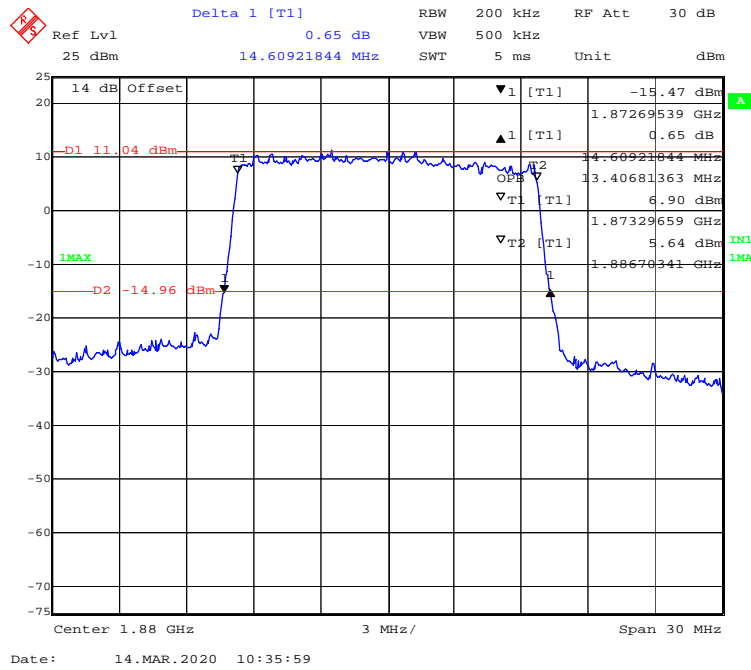
16-QAM (5.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



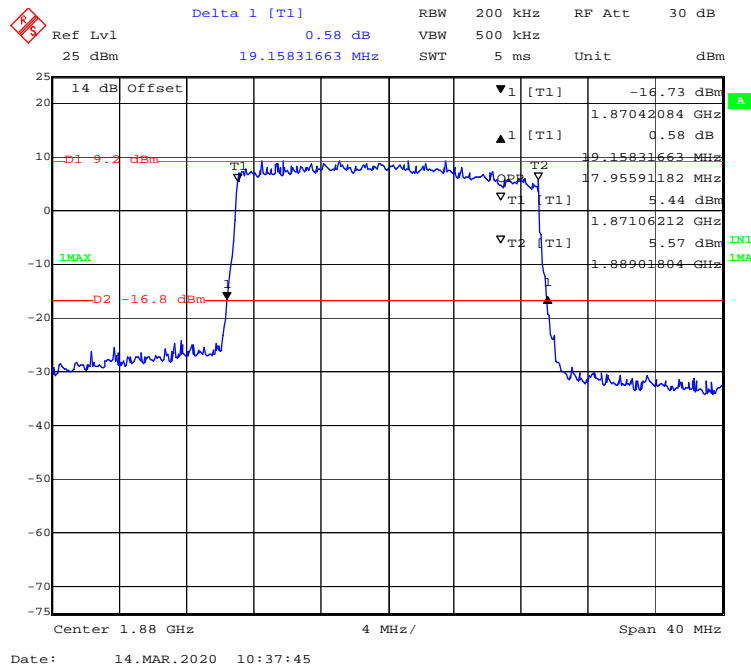
16-QAM (10.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



16-QAM (15.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



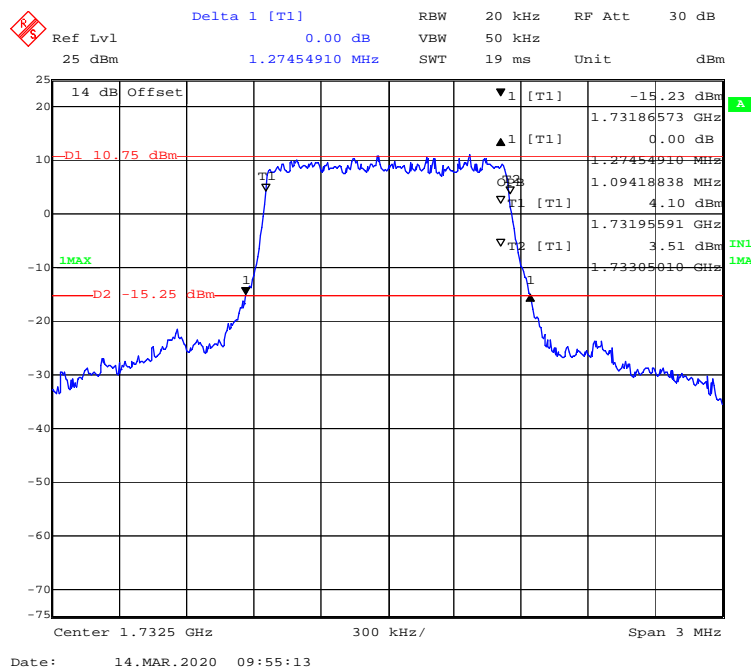
16-QAM (20.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



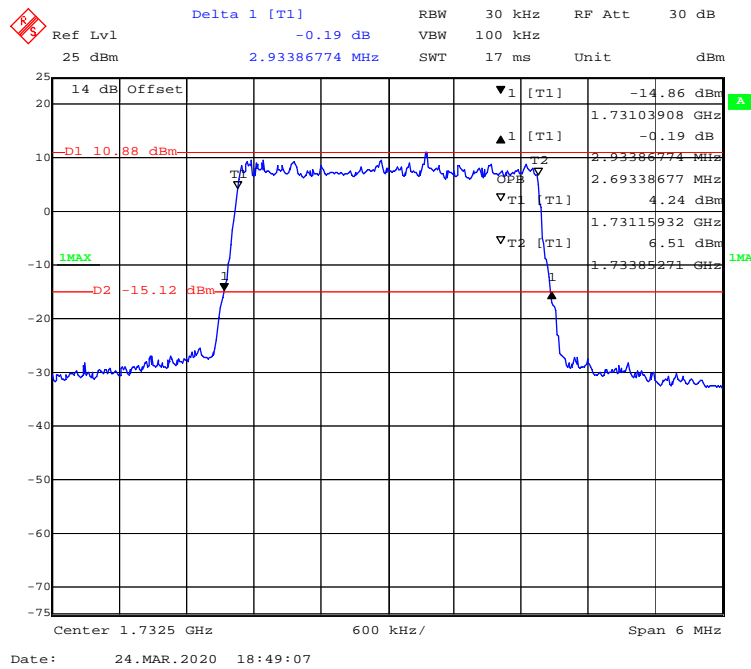
LTE Band 4:

Test Modulation	Test Bandwidth	Test Channel	26 dB Bandwidth	99% Occupied Bandwidth
			MHz	MHz
QPSK	1.4M	Middle	1.275	1.094
	3M		2.934	2.693
	5M		4.950	4.509
	10M		9.900	8.978
	15M		14.669	13.527
	20M		19.639	17.956
16-QAM	1.4M	Middle	1.305	1.094
	3M		2.946	2.705
	5M		4.930	4.489
	10M		9.820	8.978
	15M		14.669	13.467
	20M		19.399	18.036

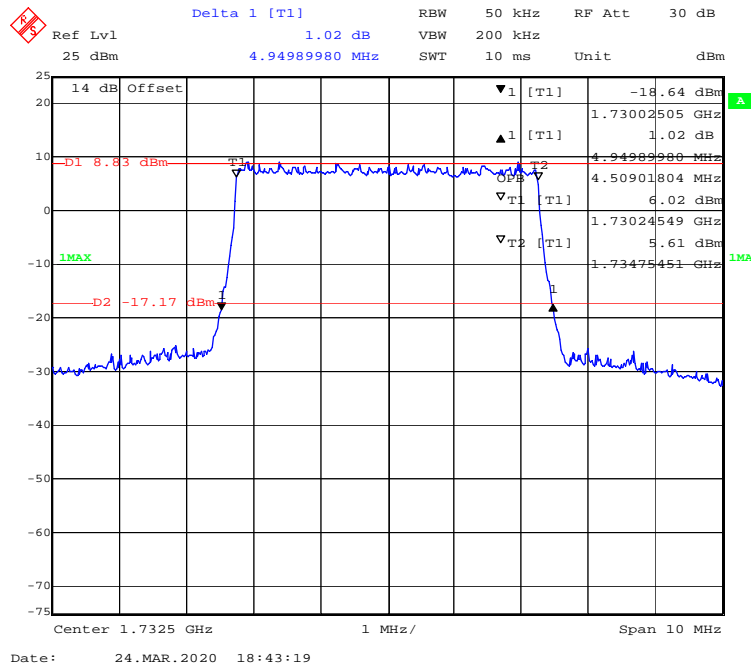
QPSK (1.4 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



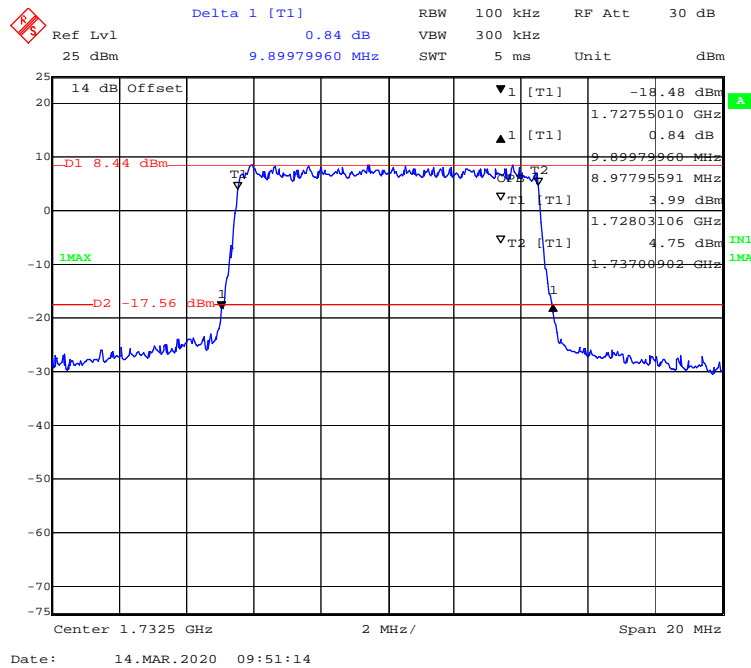
QPSK (3.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



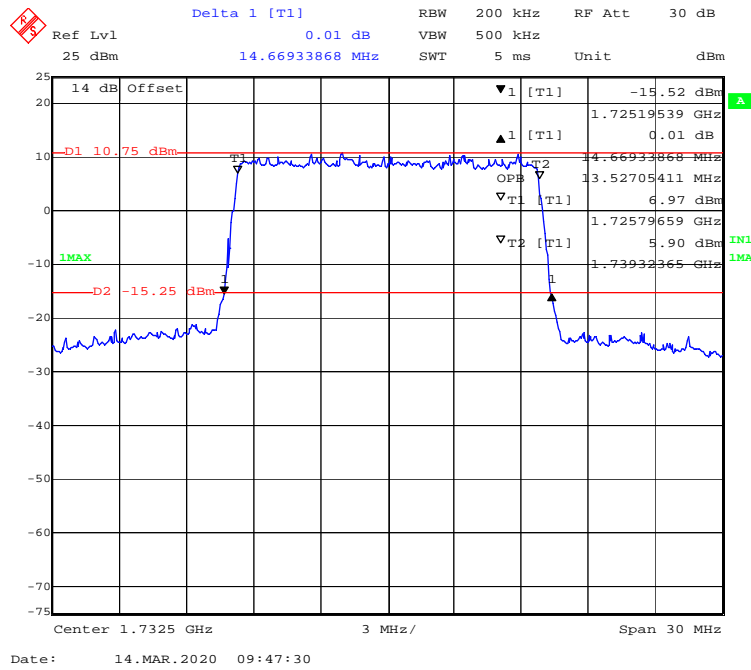
QPSK (5.0MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



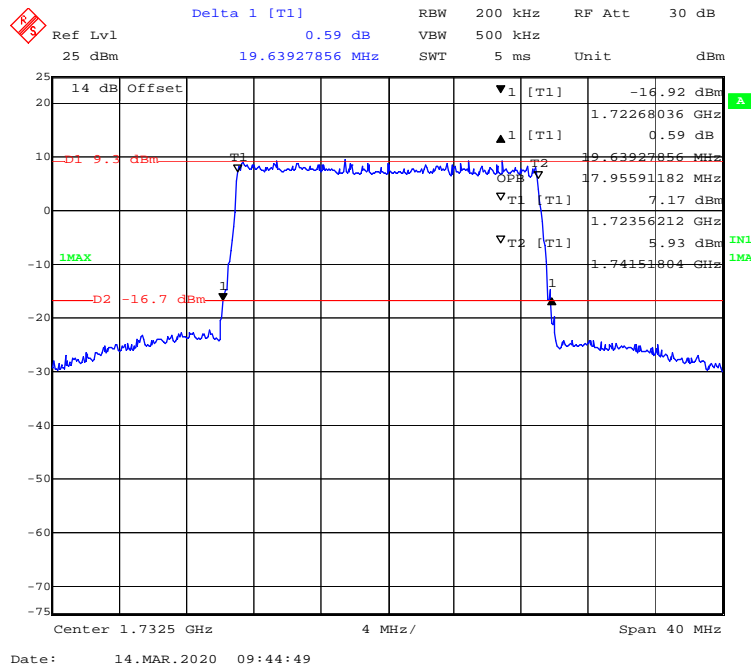
QPSK (10.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



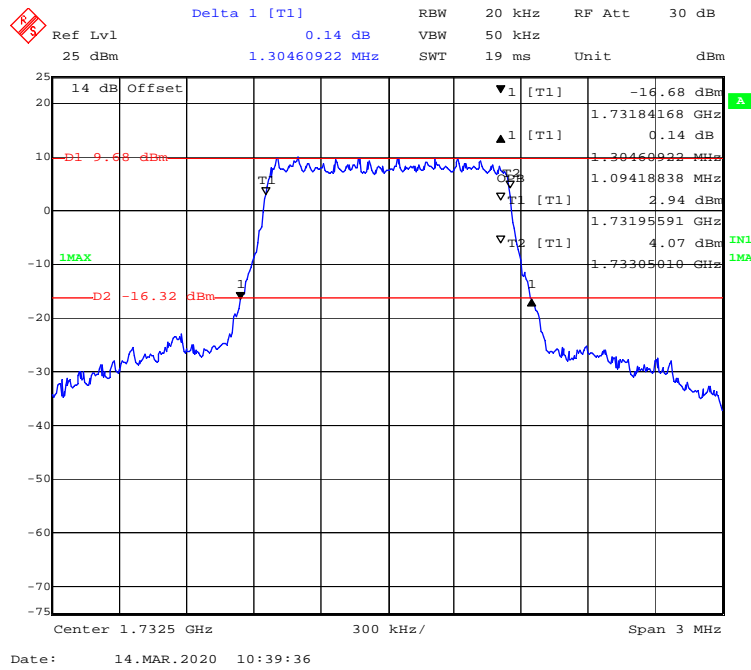
QPSK (15.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



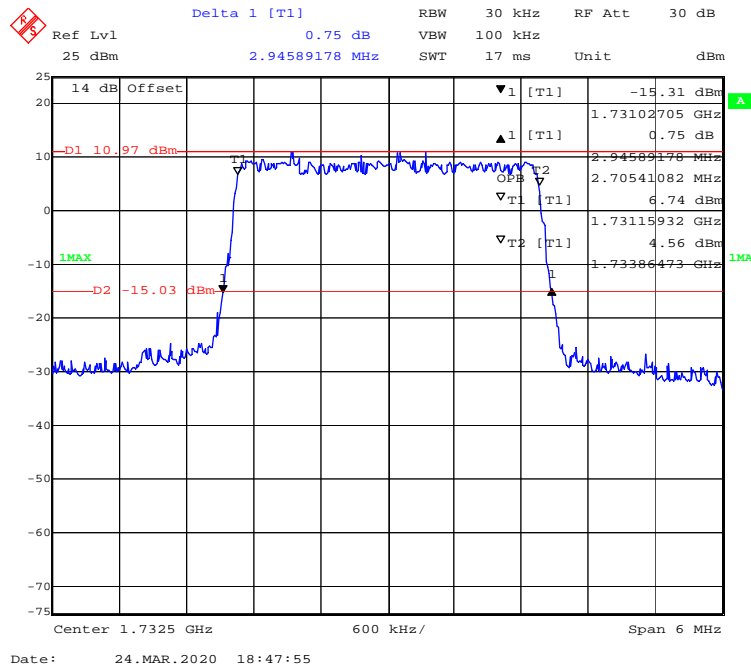
QPSK (20.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



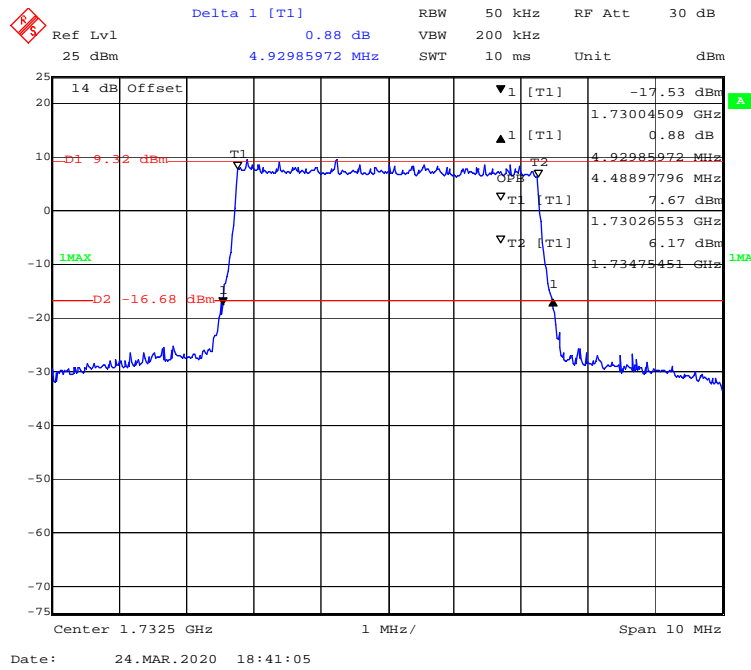
16-QAM (1.4 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



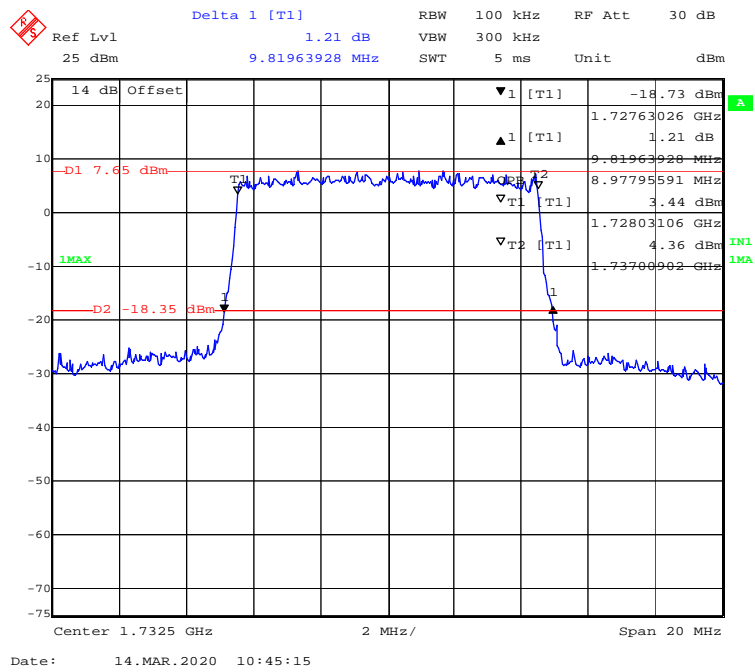
16-QAM (3.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



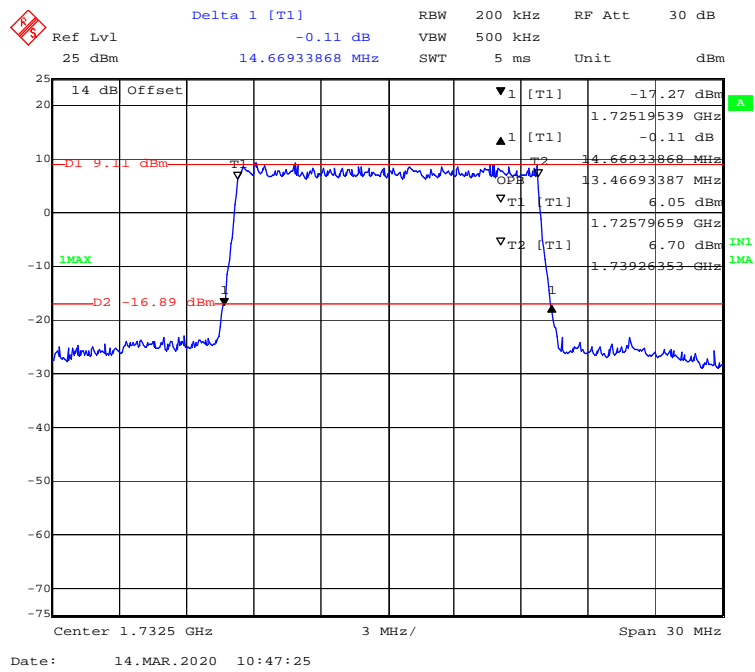
16-QAM (5.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



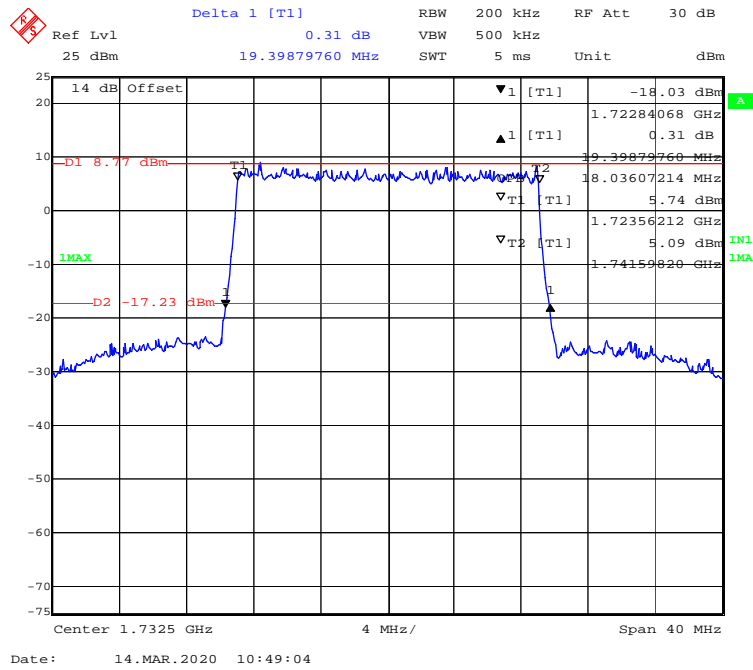
16-QAM (10.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



16-QAM (15.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



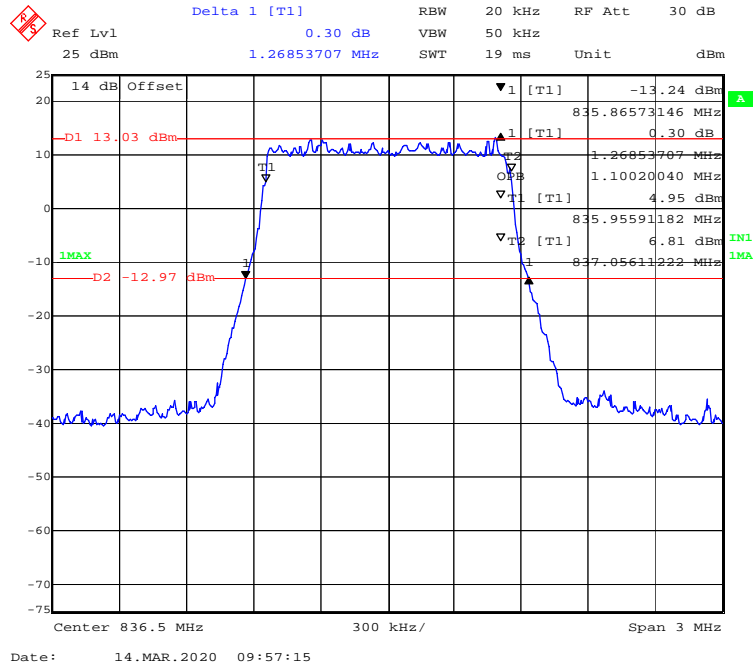
16-QAM (20.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



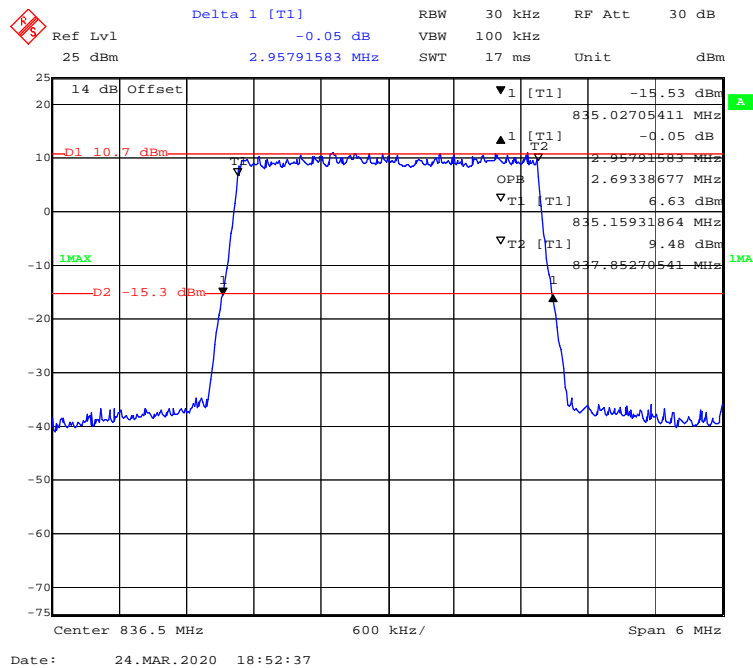
LTE Band 5:

Test Modulation	Test Bandwidth	Test Channel	26 dB Bandwidth	99% Occupied Bandwidth
			MHz	MHz
QPSK	1.4M	Middle	1.269	1.100
	3M		2.958	2.693
	5M		4.930	4.489
	10M		9.860	8.938
16-QAM	1.4M	Middle	1.293	1.094
	3M		2.934	2.693
	5M		4.930	4.489
	10M		9.619	8.938

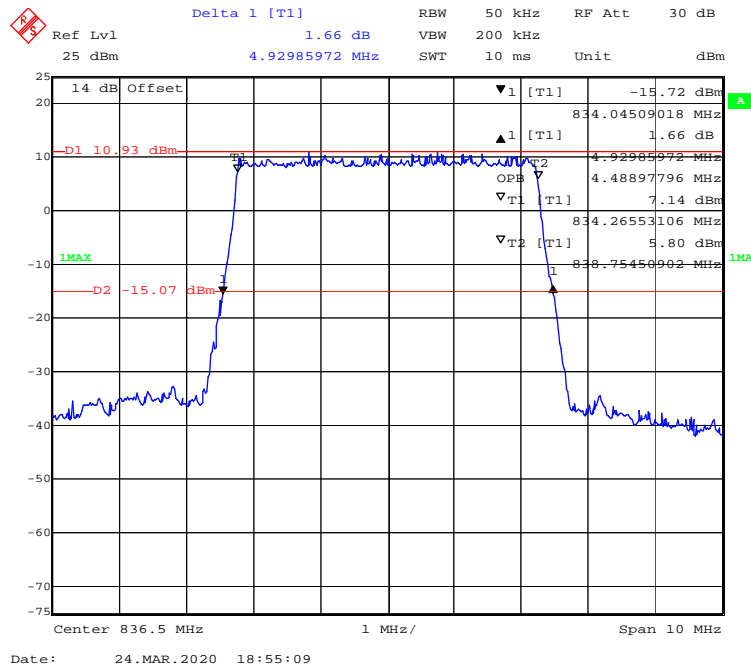
QPSK (1.4 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



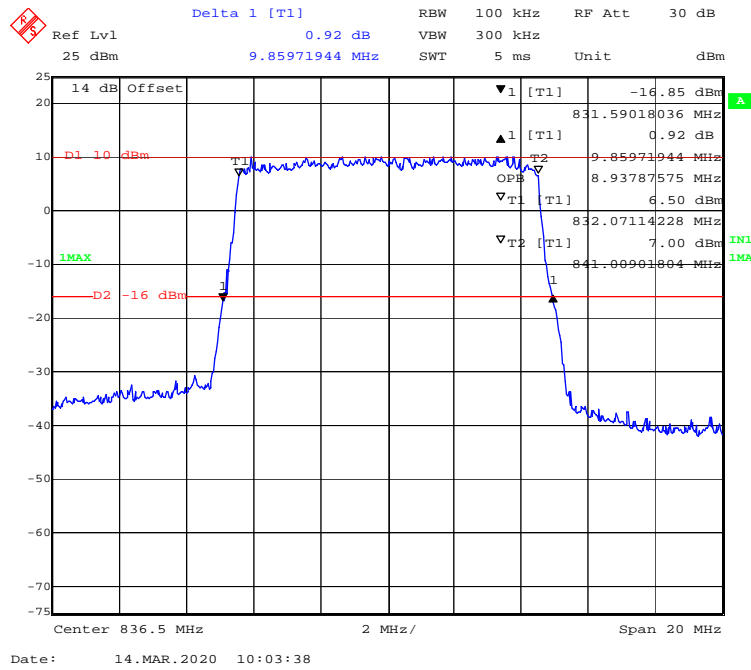
QPSK (3.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



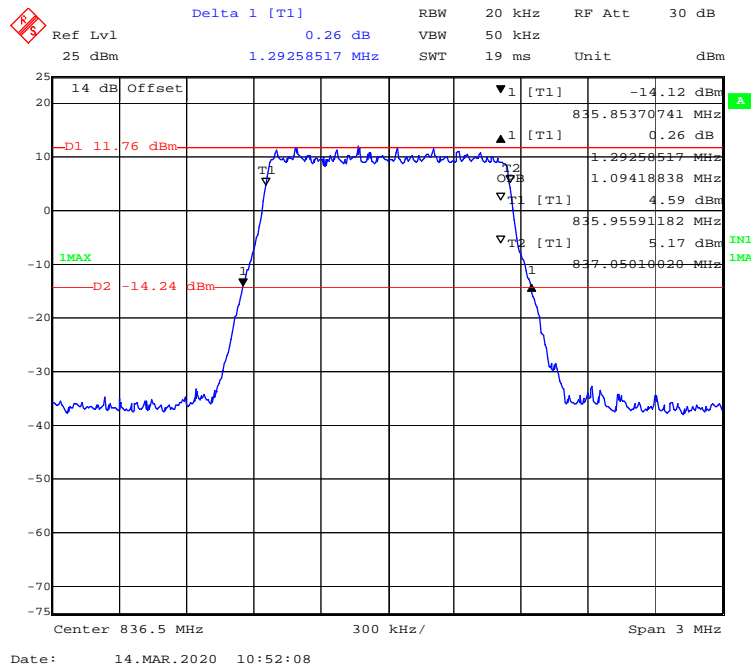
QPSK (5.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



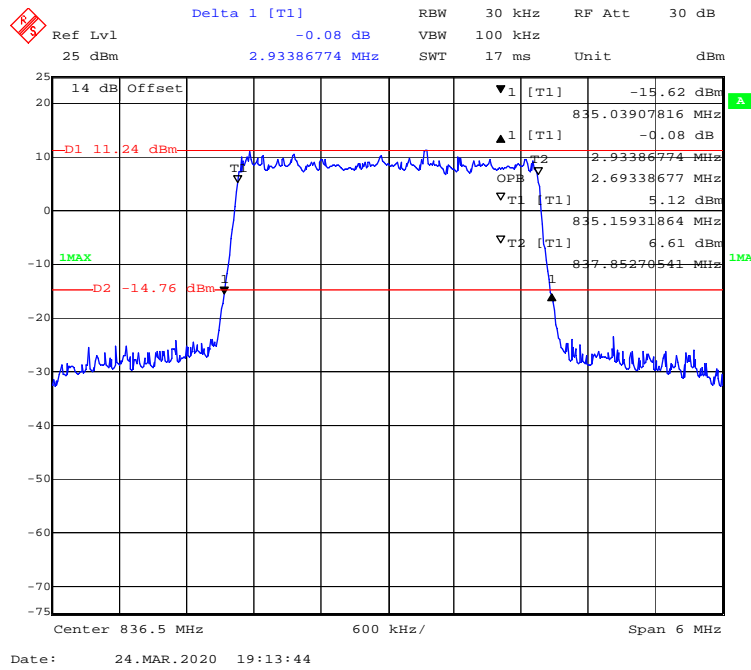
QPSK (10.0MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



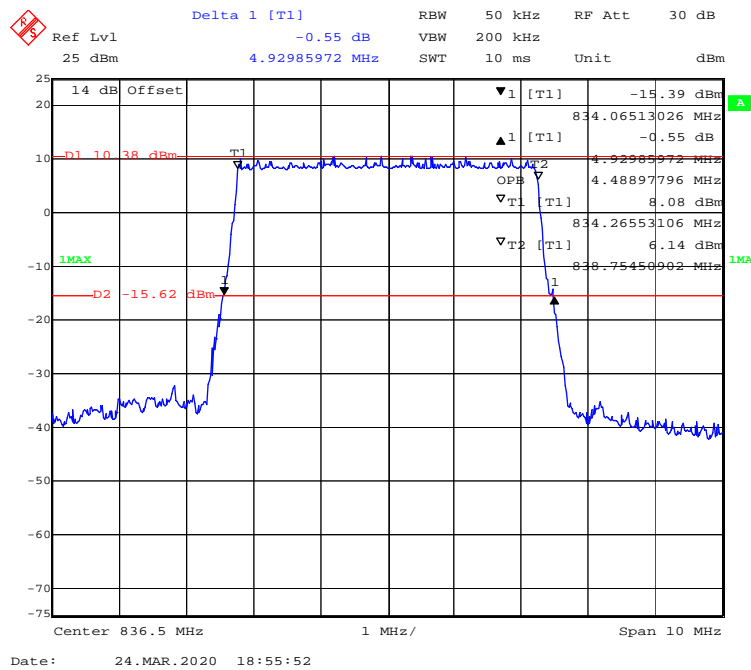
16-QAM (1.4 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



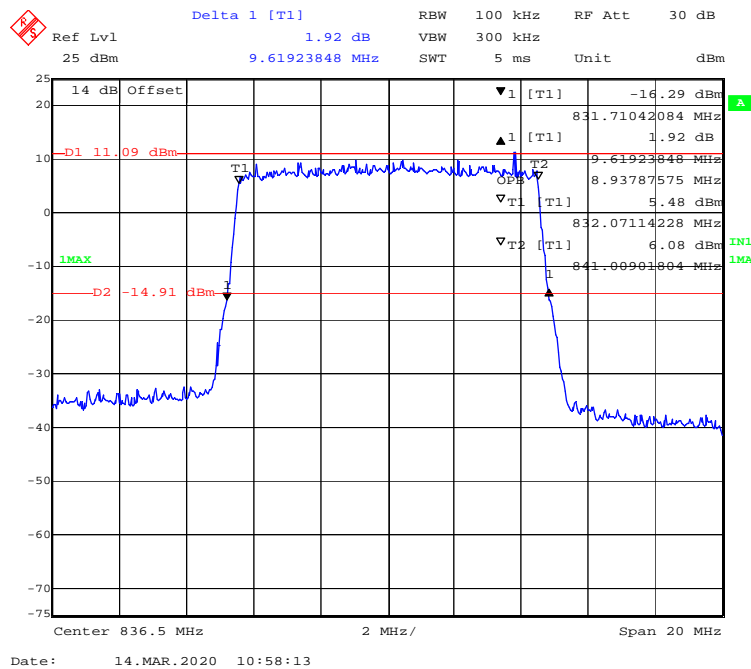
16-QAM (3.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



16-QAM (5.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



16-QAM (10.0 MHz) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



FCC § 2.1051; § 22.917 (a); § 24.238 (a); §27.53 (h) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

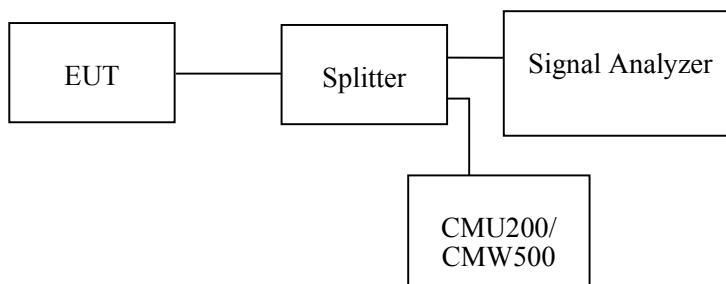
Applicable Standards

FCC §2.1051, §22.917(a) and §24.238(a) and §27.53(h).

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 100 kHz for below 1GHz & 1MHz for above 1GHz. sufficient scans were taken to show any out of band emissions up to 10th harmonic.



Test Data

Environmental Conditions

Temperature:	23.2 °C
Relative Humidity:	51 %
ATM Pressure:	101.1 kPa

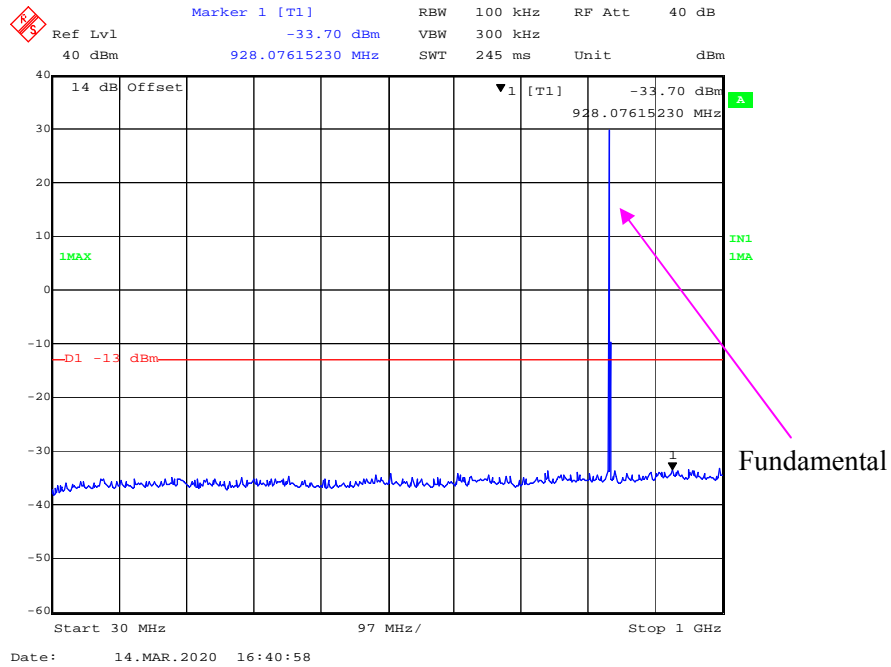
The testing was performed by CK Huang on 2020-03-14.

EUT operation mode: Transmitting

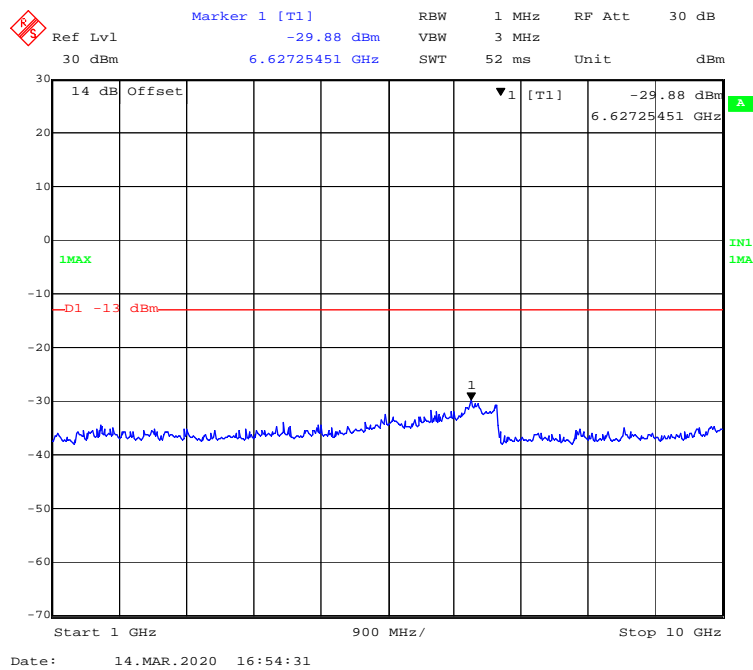
Test Result: Compliant.

GSM 850 Band:

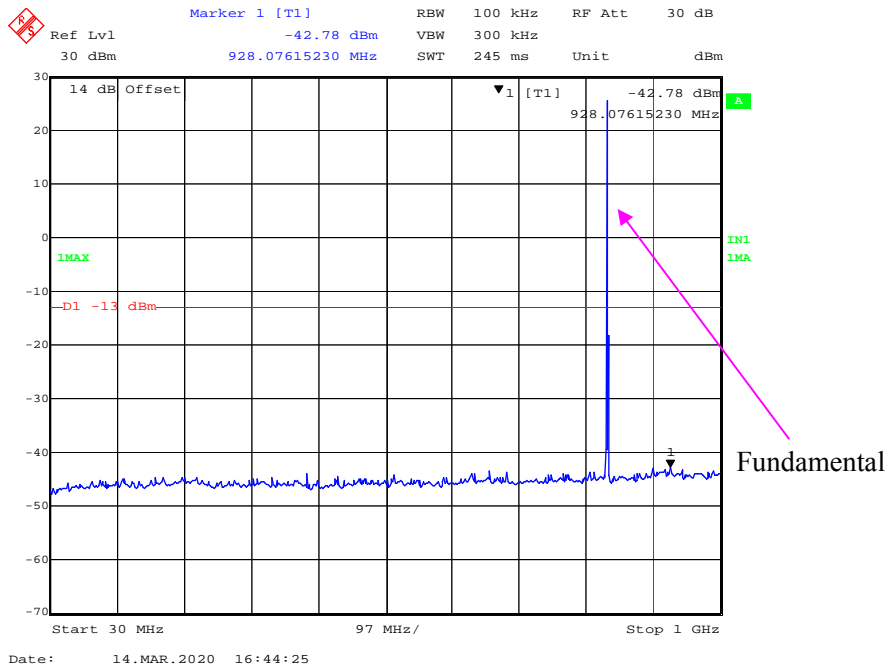
30 MHz – 1GHz(GPRS Mode)



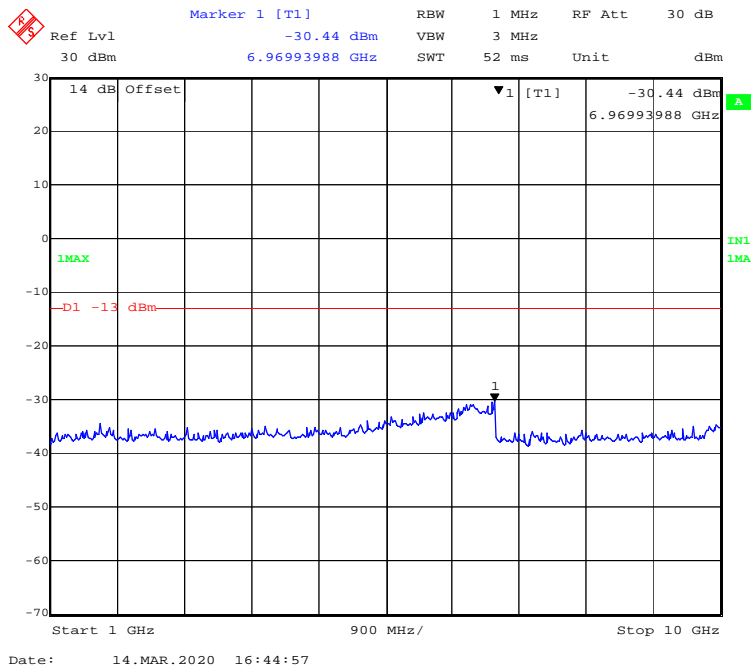
1 GHz – 10 GHz (GPRS Mode)



30 MHz – 1GHz(EGPRS Mode)

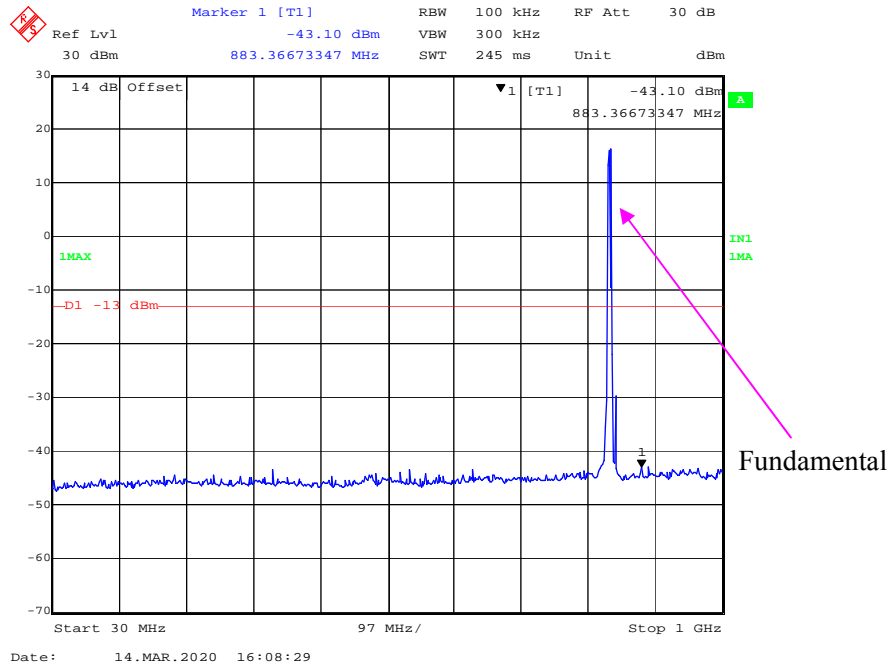


1 GHz – 10 GHz (EGPRS Mode)

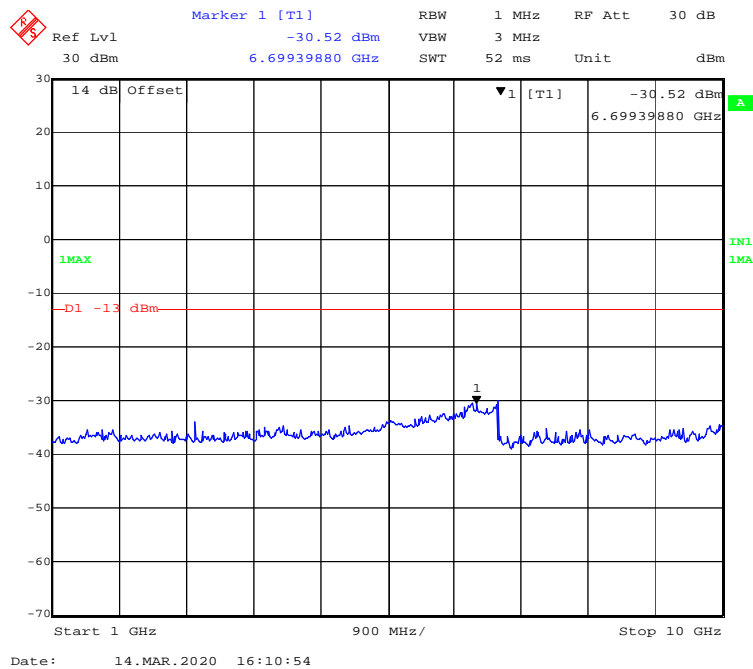


WCDMA Band V:

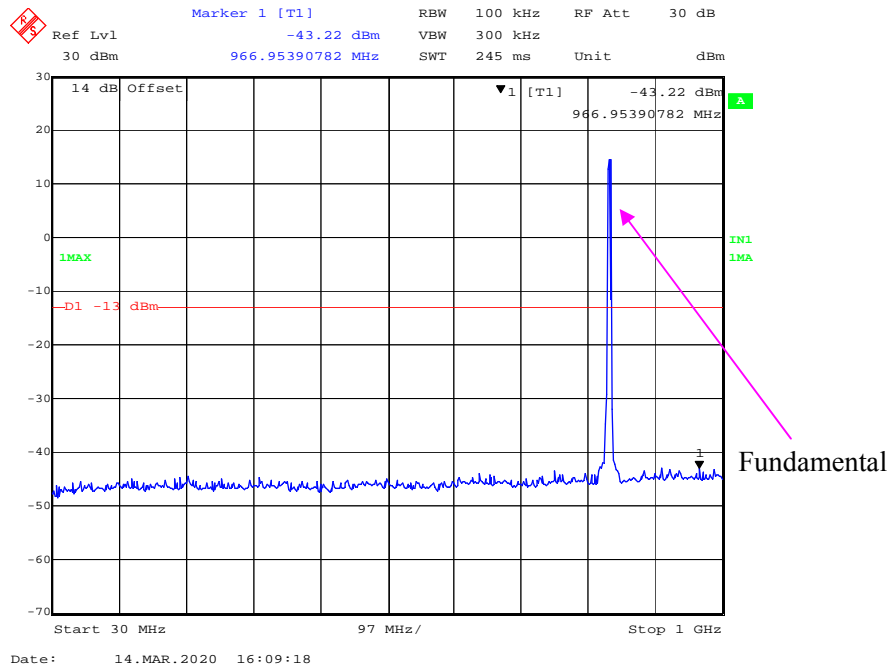
30 MHz – 1GHz WCDMA (Rel 99) Mode



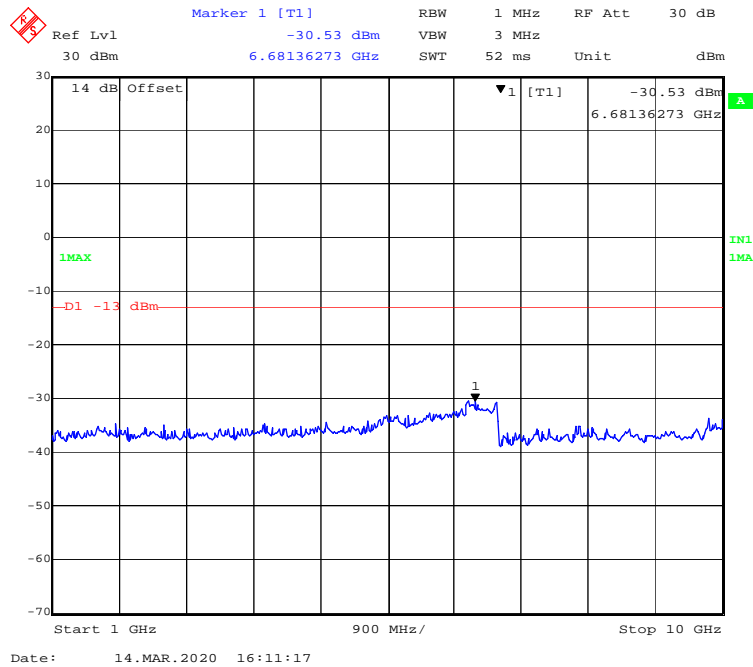
1 GHz – 10 GHz WCDMA (Rel 99) Mode



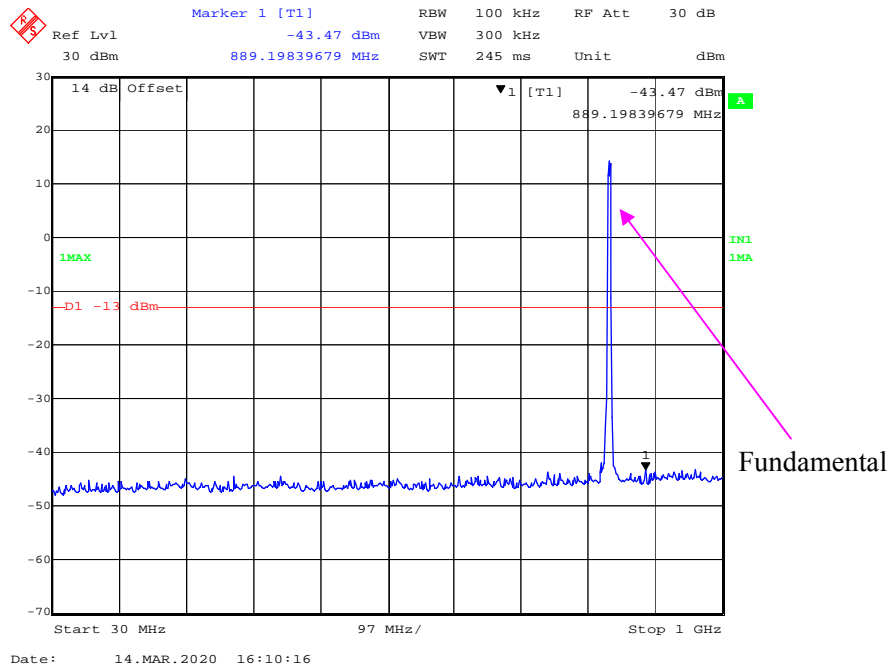
30 MHz – 1GHz WCDMA (HSDPA) Mode



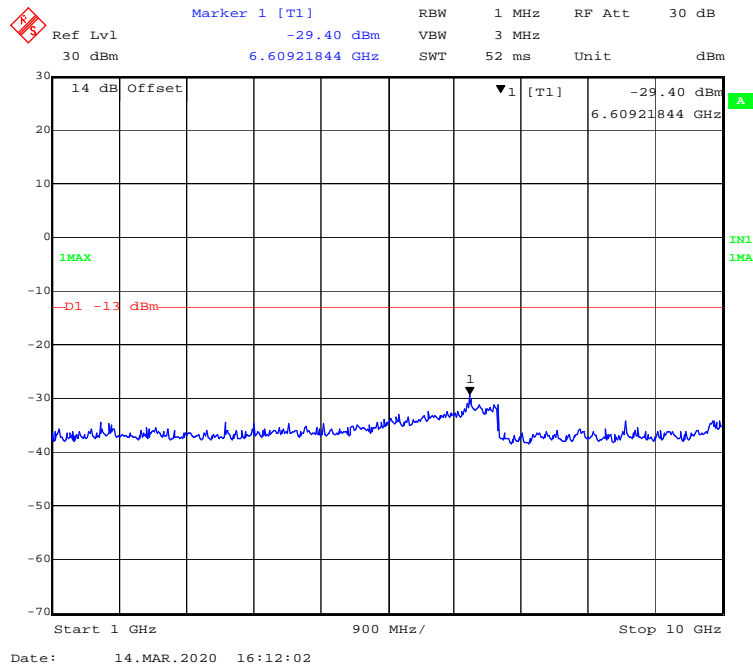
1 GHz – 10 GHz WCDMA (HSDPA) Mode



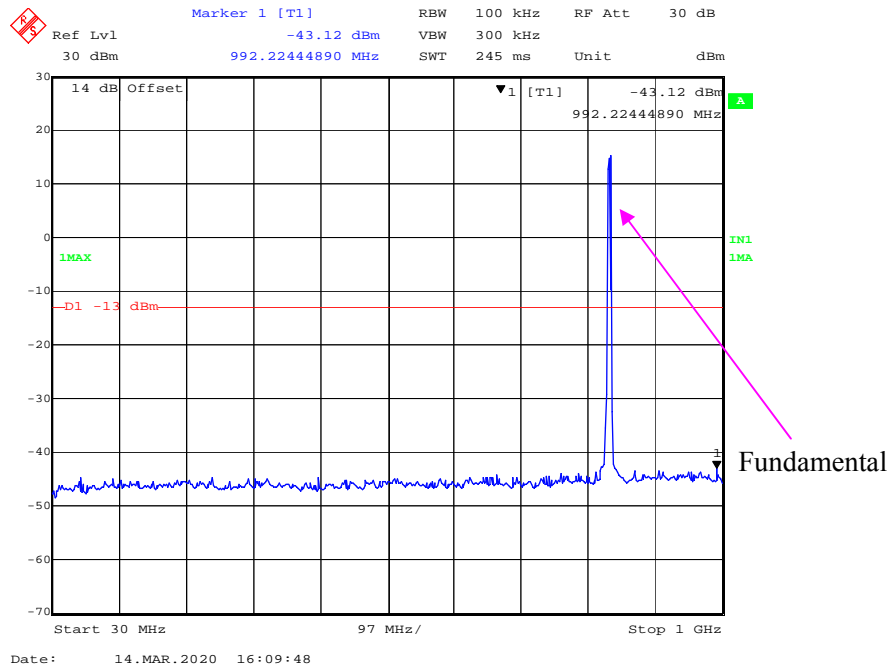
30 MHz – 1GHz WCDMA (HSUPA) Mode



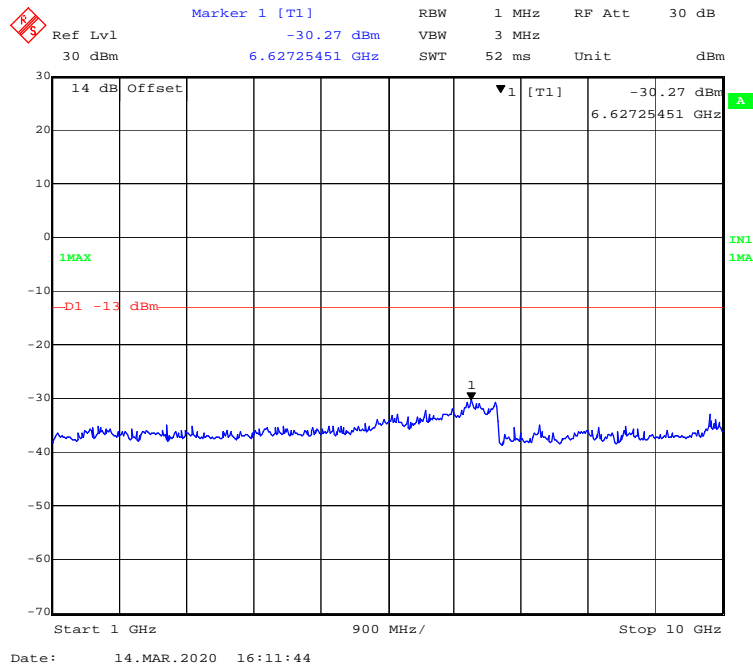
1 GHz – 10 GHz WCDMA (HSUPA) Mode



30 MHz – 1GHz WCDMA (HSPA+) Mode

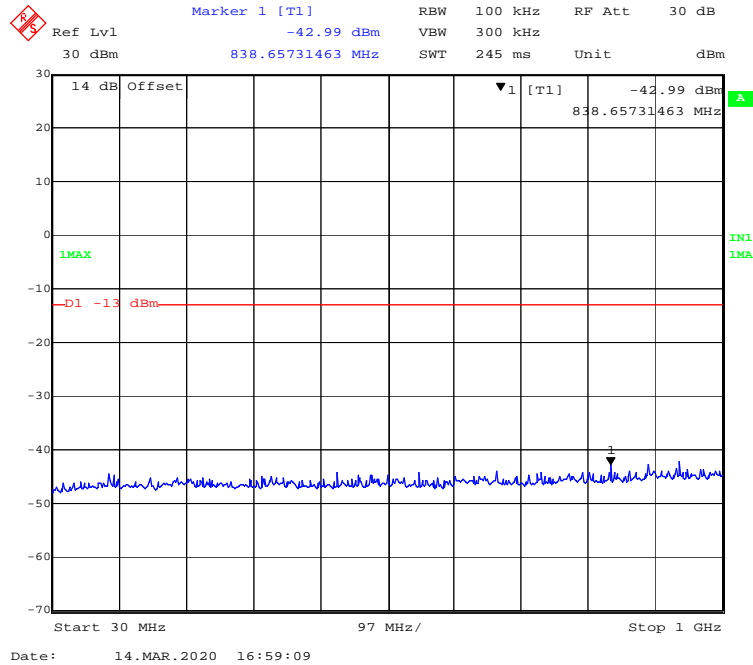


1 GHz – 10 GHz WCDMA (HSPA+) Mode

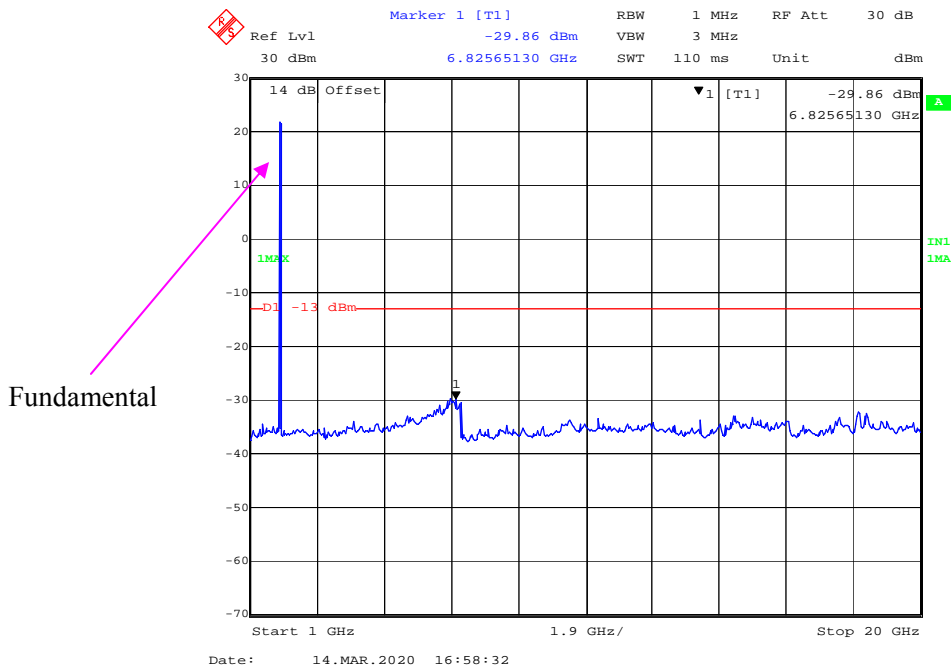


PCS 1900 Band:

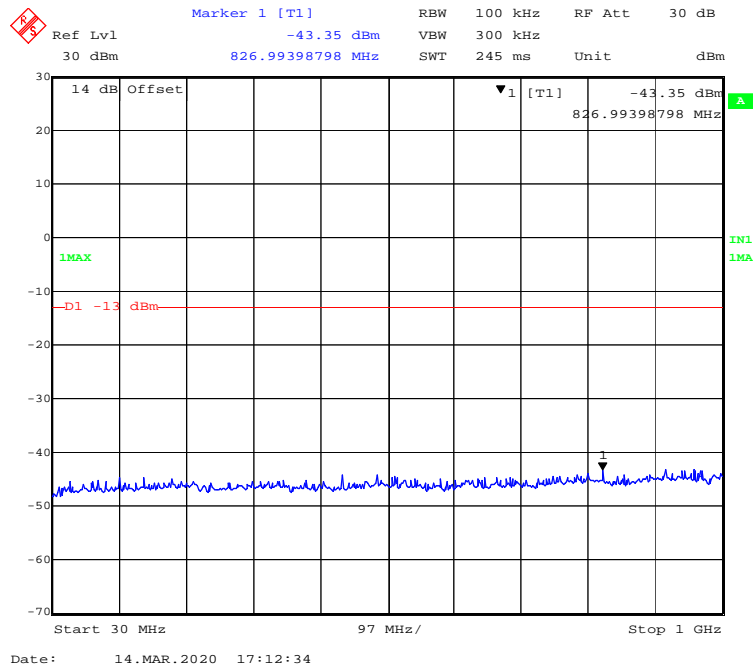
30 MHz – 1GHz(GPRS Mode)



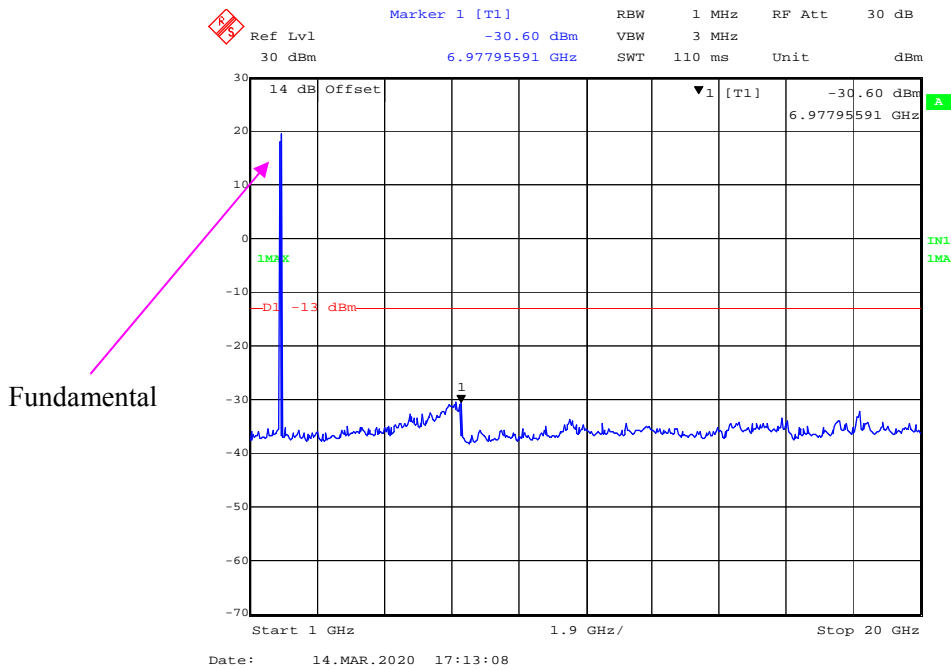
1 GHz – 20 GHz (GPRS Mode)



30 MHz – 1GHz(EGPRS Mode)

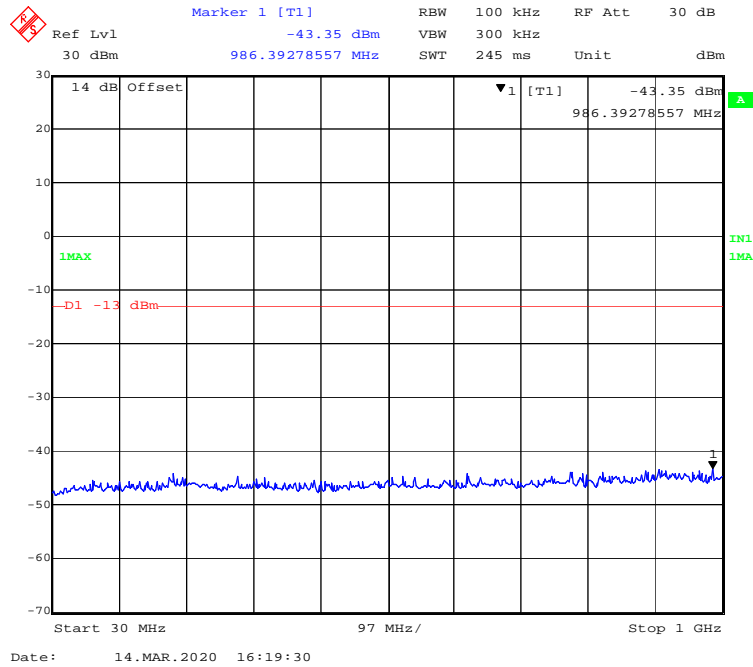


1 GHz – 20 GHz (EGPRS Mode)

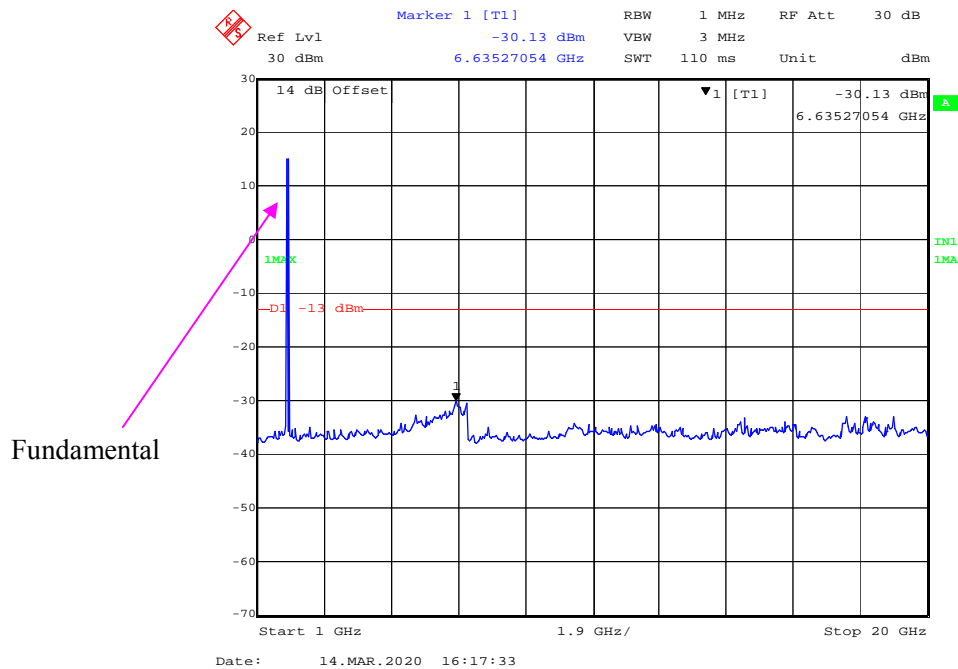


WCDMA Band II:

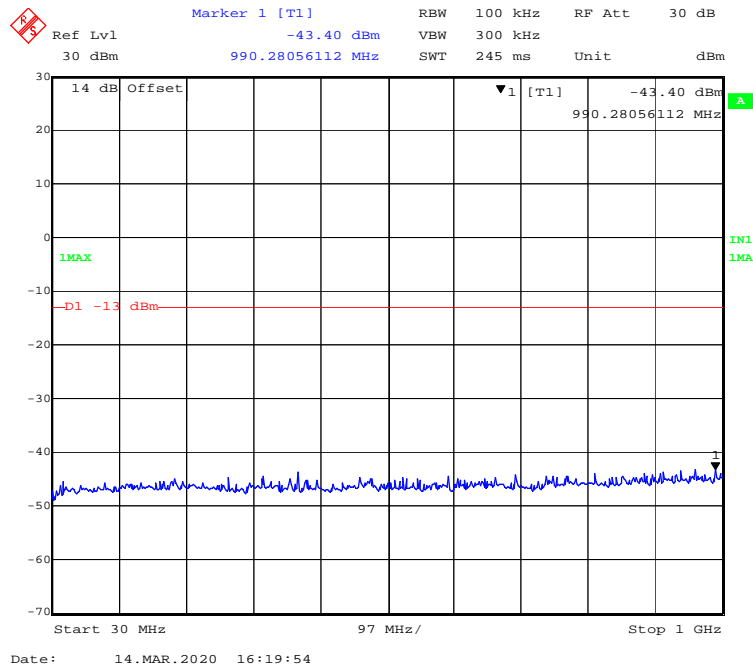
30 MHz – 1GHz WCDMA (Rel 99) Mode



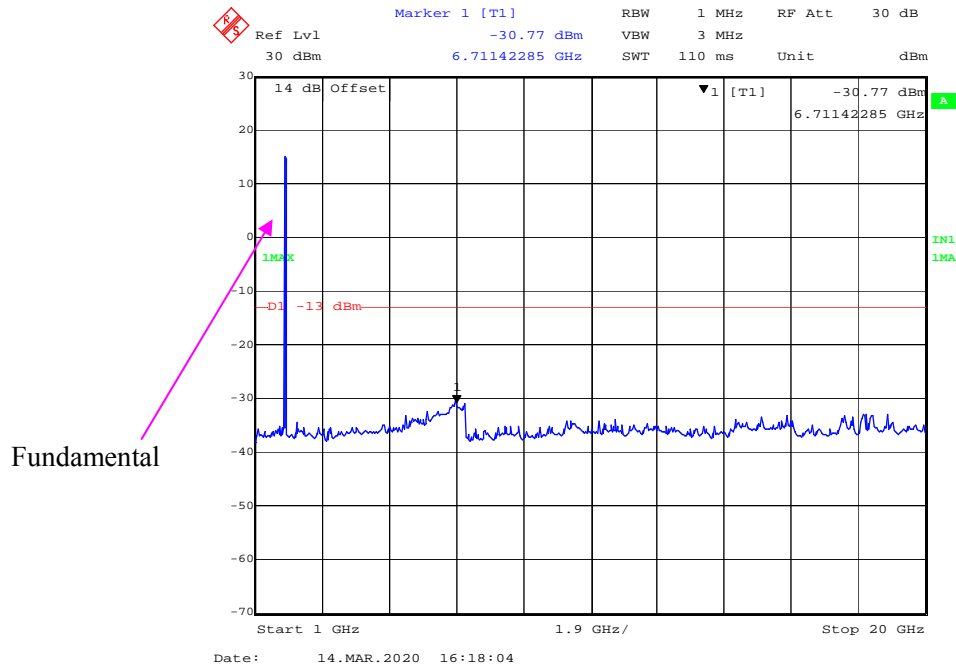
1 GHz – 20 GHz WCDMA (Rel 99) Mode



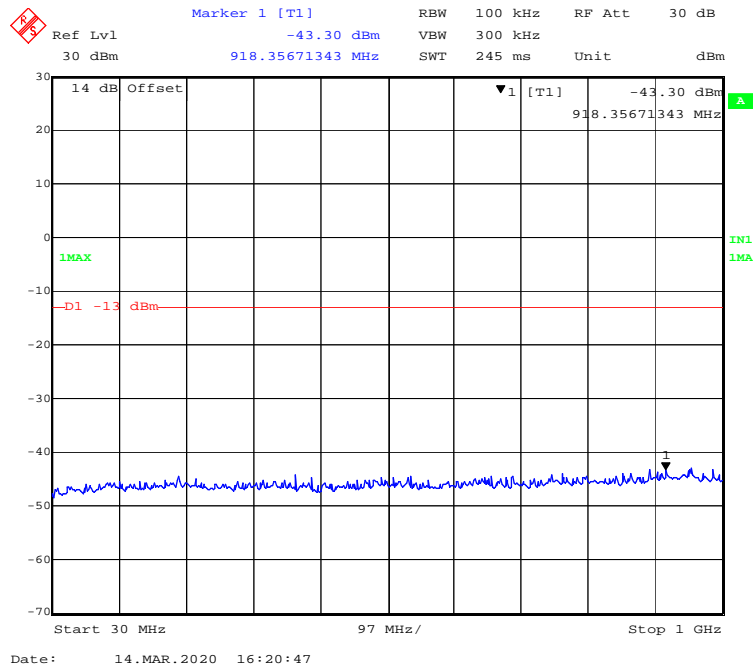
30 MHz – 1GHz WCDMA (HSDPA) Mode



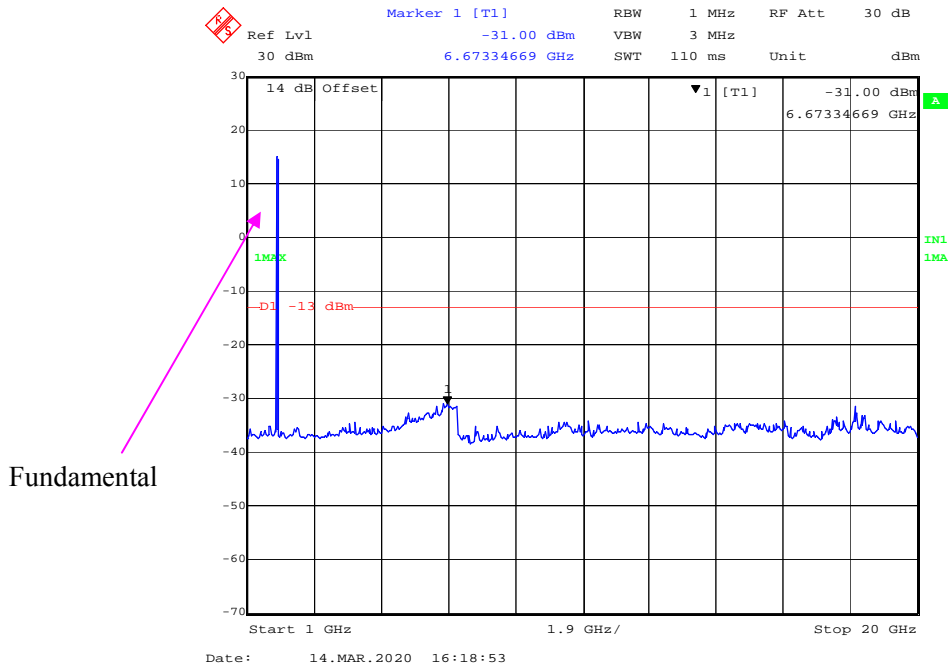
1 GHz – 20 GHz WCDMA (HSDPA) Mode



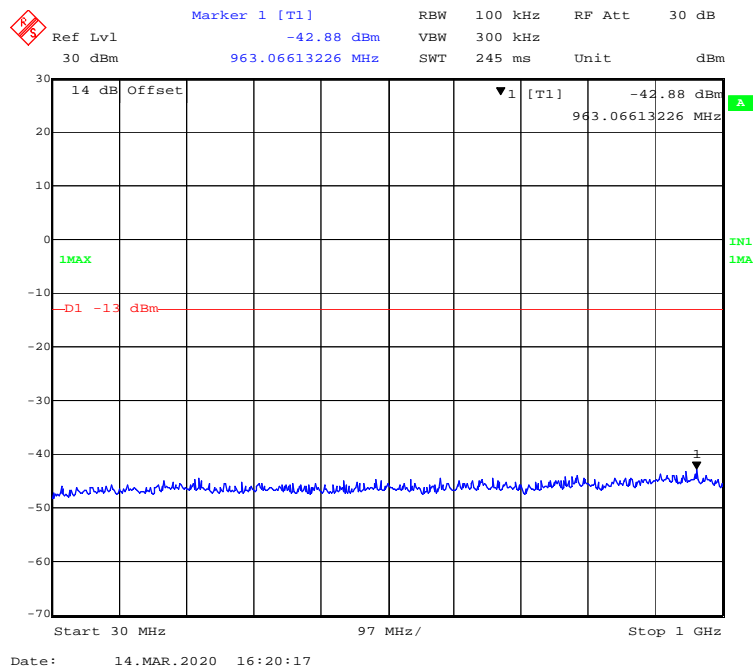
30 MHz – 1GHz WCDMA (HSUPA) Mode



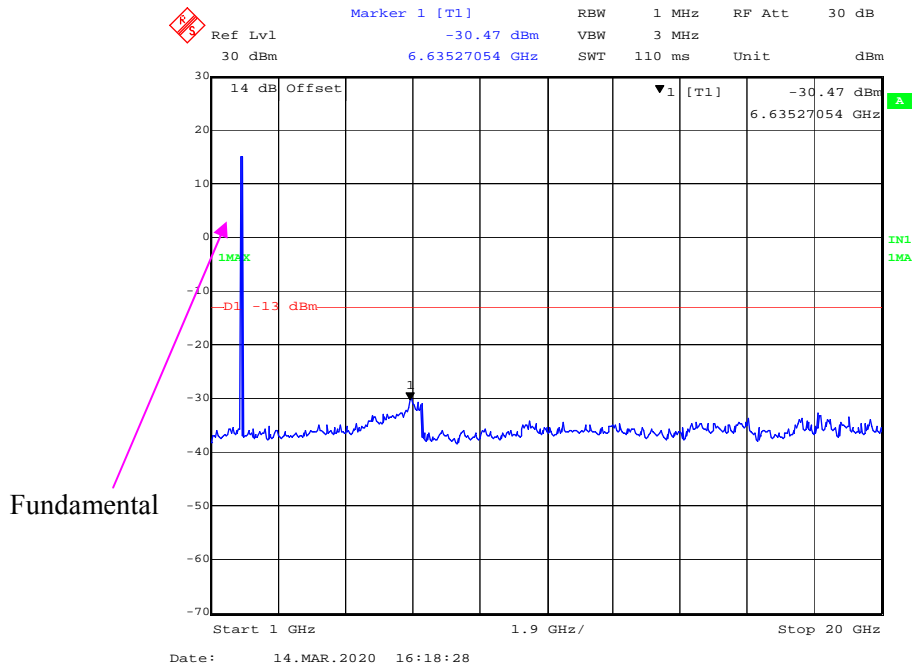
1 GHz – 20 GHz WCDMA (HSUPA) Mode



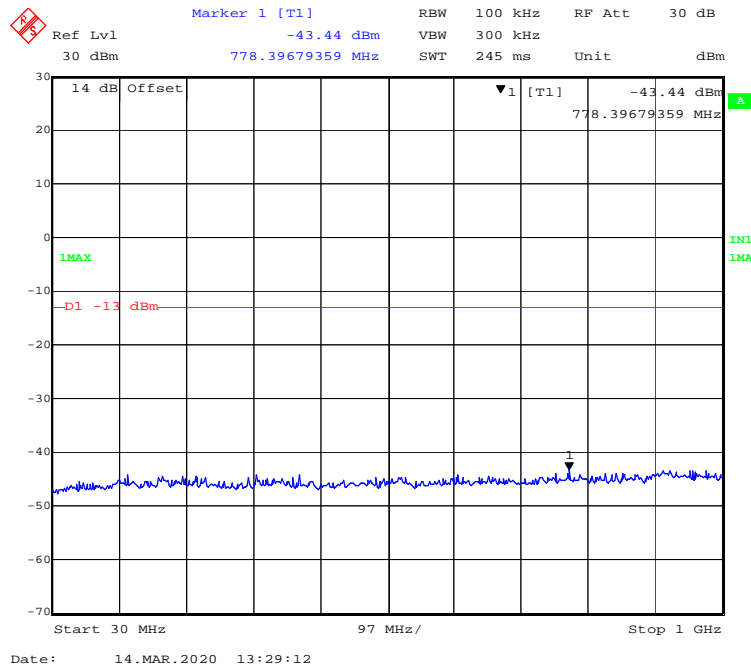
30 MHz – 1GHz WCDMA (HSPA+) Mode



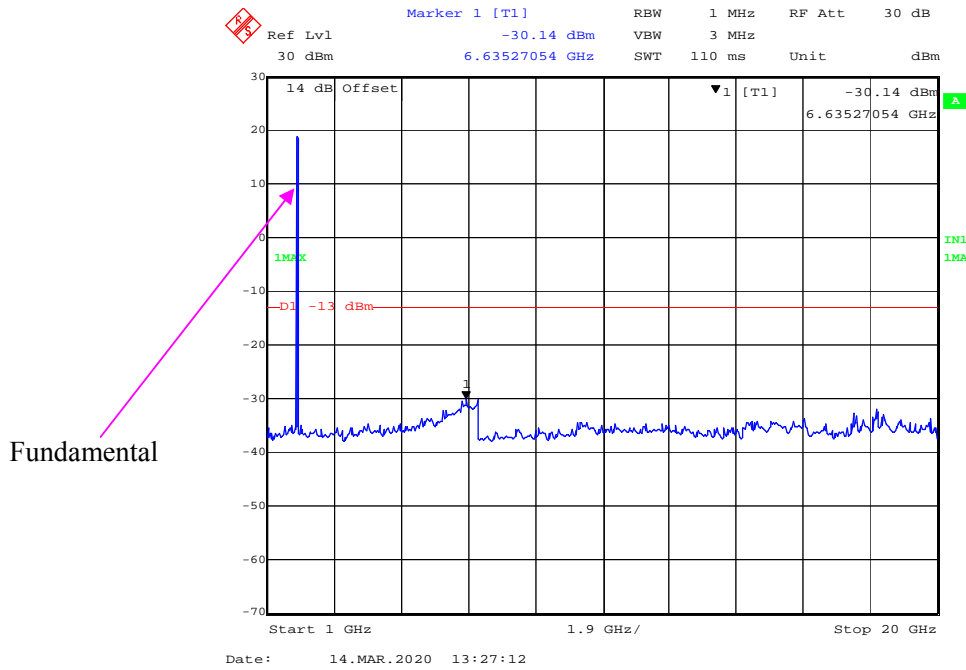
1 GHz – 20 GHz WCDMA (HSPA+) Mode



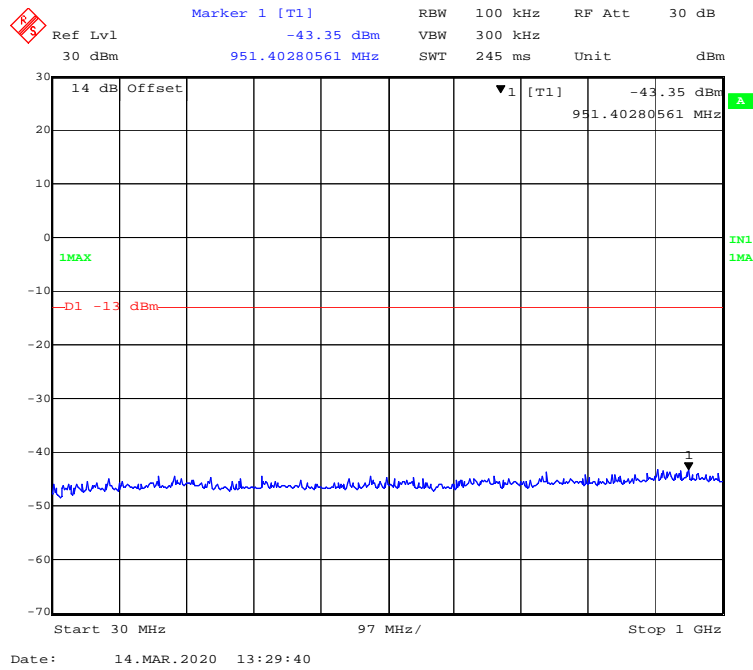
30 MHz - 1 GHz (QPSK, 5.0 MHz, Middle Channel)



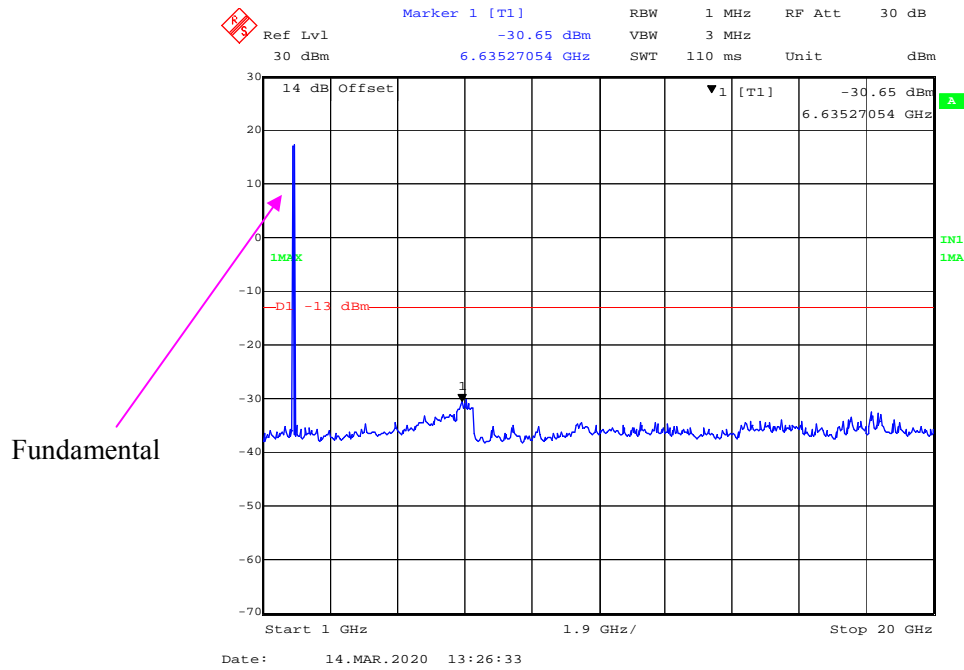
1 GHz – 20 GHz (QPSK, 5.0MHz, Middle Channel)



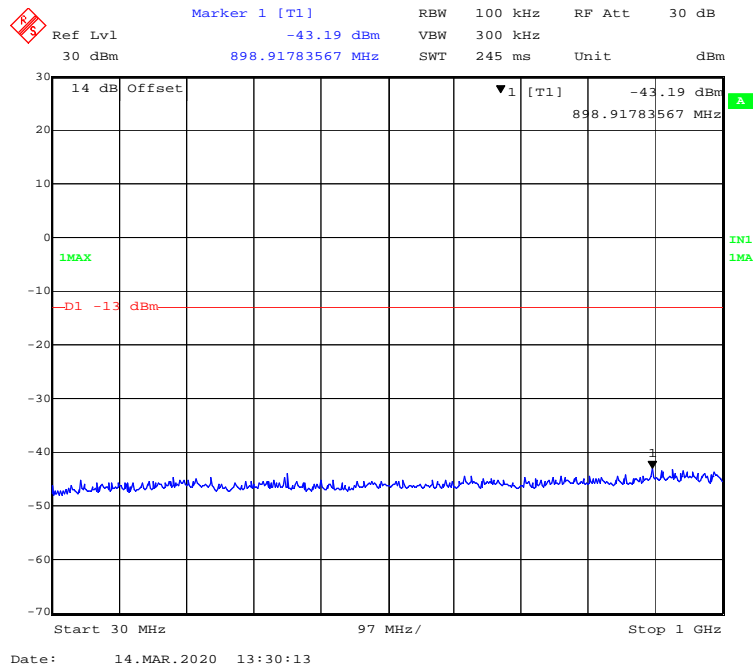
30 MHz - 1 GHz (QPSK, 10.0 MHz, Middle Channel)



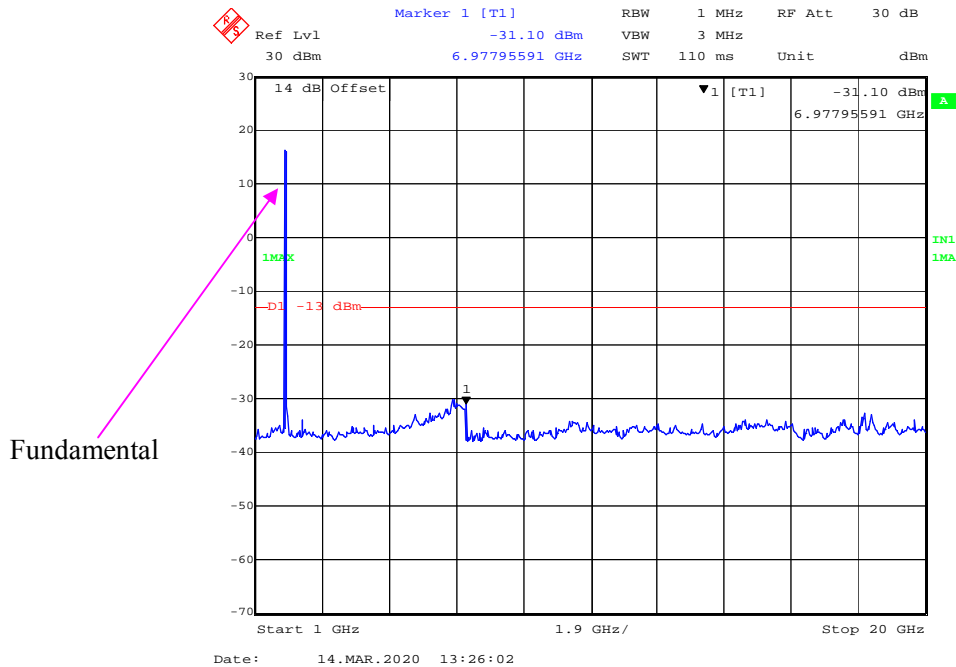
1 GHz – 20 GHz (QPSK, 10.0 MHz, Middle Channel)



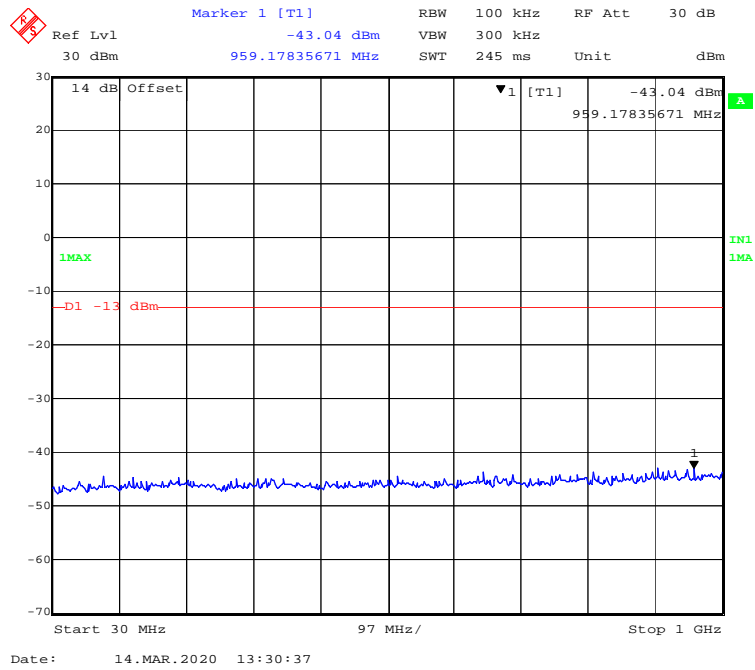
30 MHz - 1 GHz (QPSK, 15.0 MHz, Middle Channel)



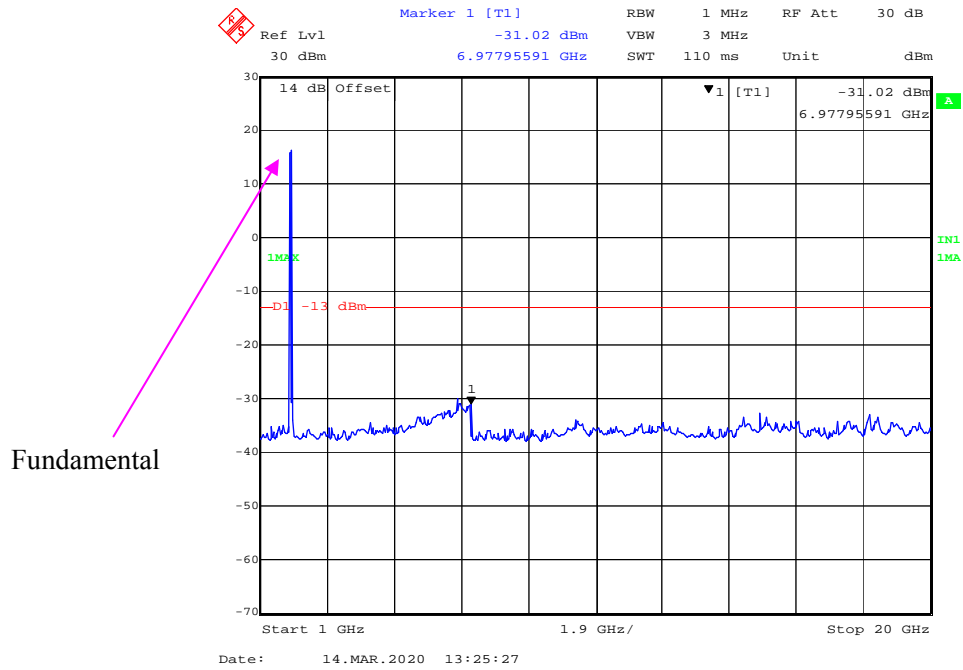
1 GHz – 20 GHz (QPSK, 15.0 MHz, Middle Channel)



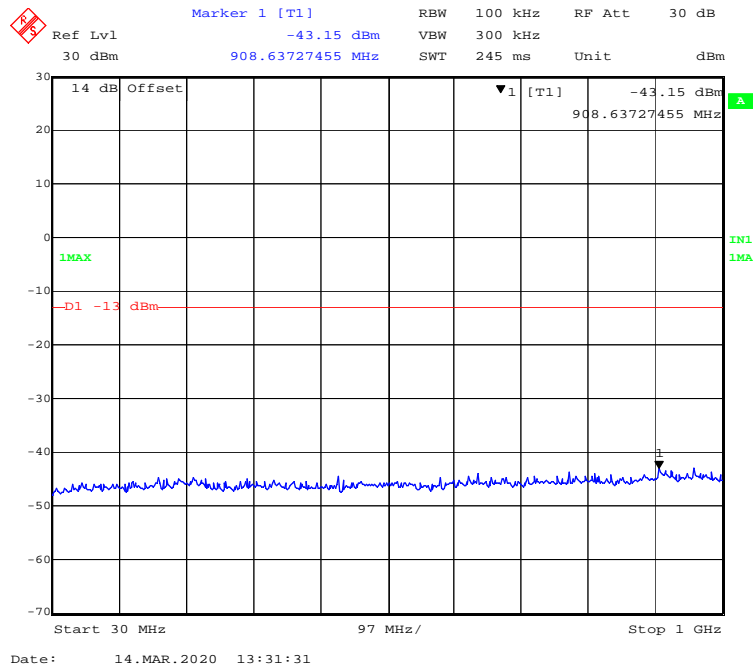
30 MHz - 1 GHz (QPSK, 20.0 MHz, Middle Channel)



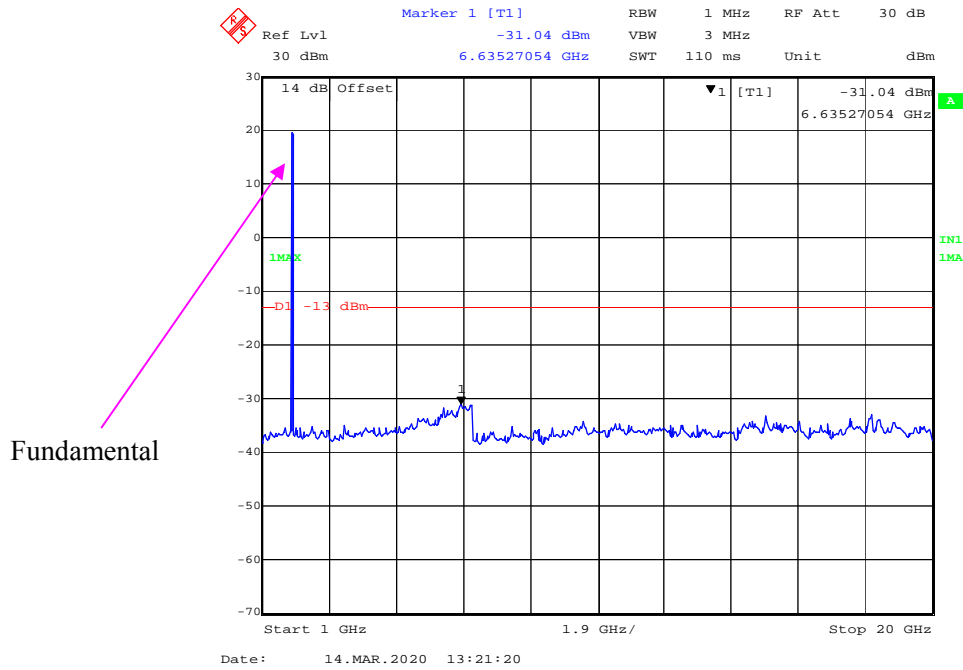
1 GHz - 20 GHz (QPSK, 20.0 MHz, Middle Channel)



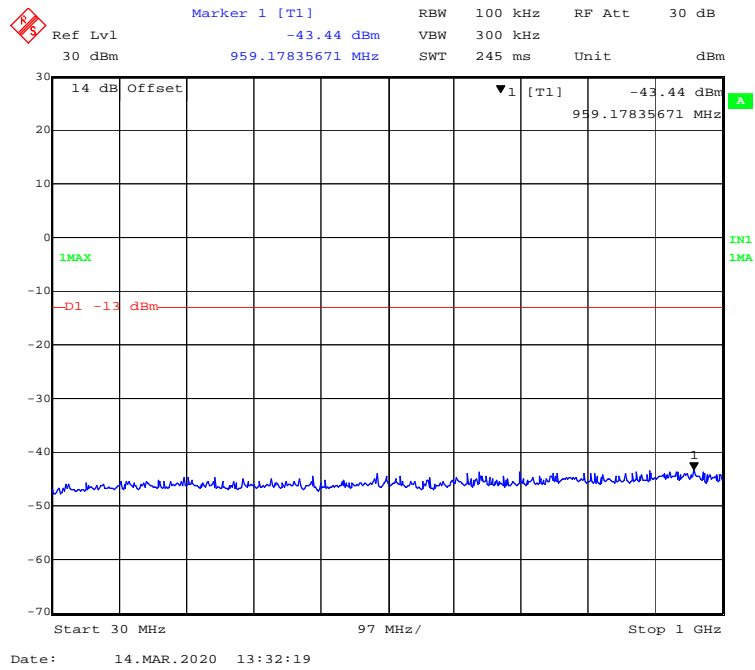
30 MHz - 1 GHz (16QAM, 3.0 MHz, Middle Channel)



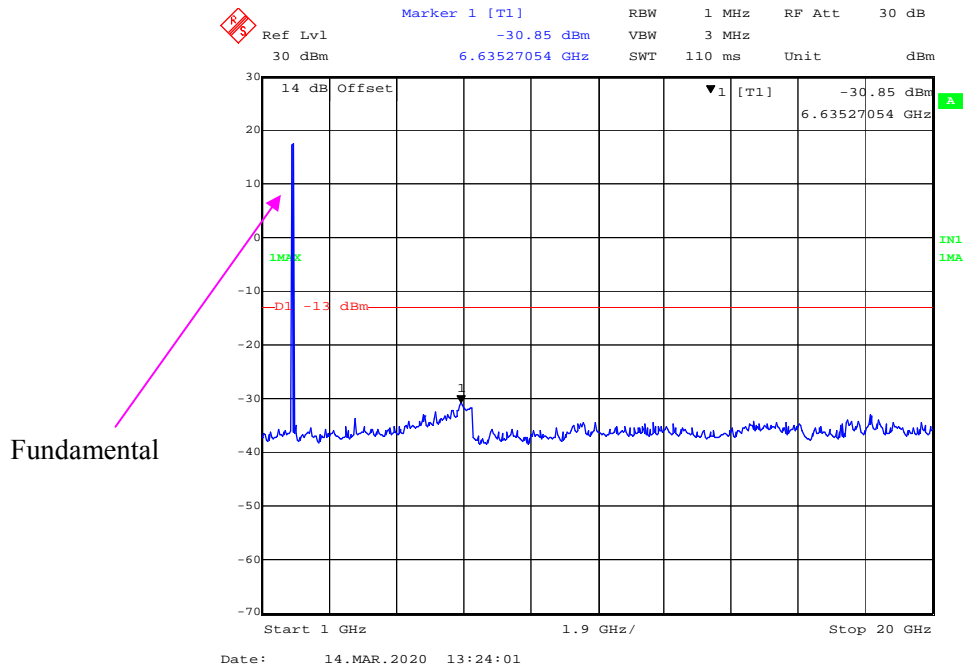
1 GHz – 20 GHz (16QAM, 3.0 MHz, Middle Channel)



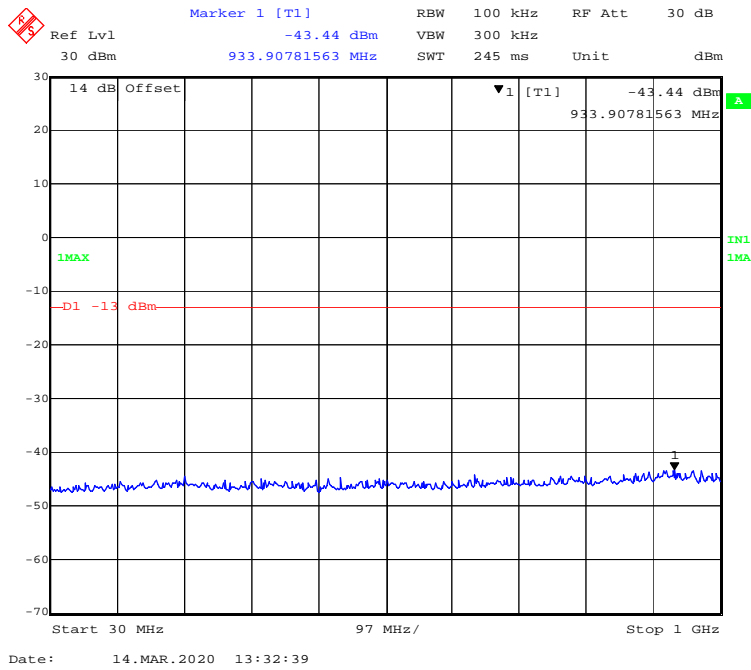
30 MHz - 1 GHz (16QAM, 10.0 MHz, Middle Channel)



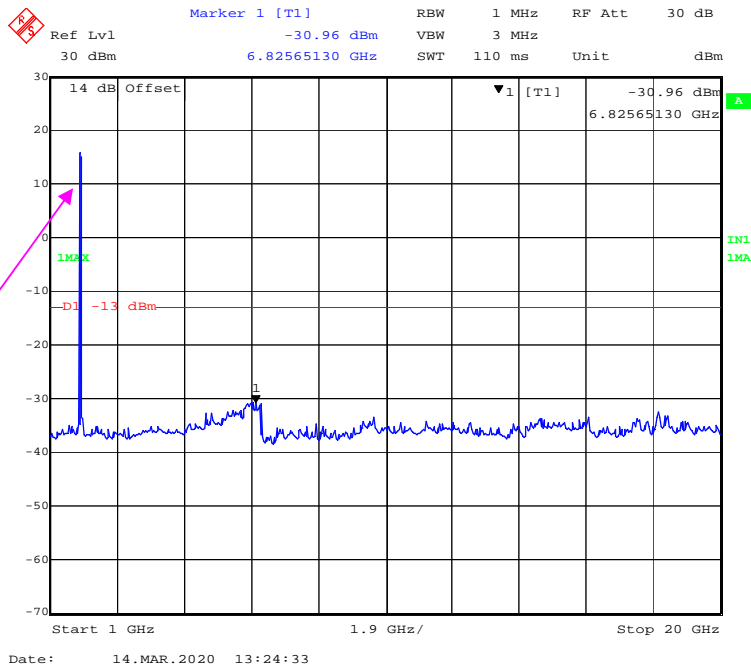
1 GHz – 20 GHz (16QAM, 10.0 MHz, Middle Channel)



30 MHz - 1 GHz (16QAM, 15.0 MHz, Middle Channel)

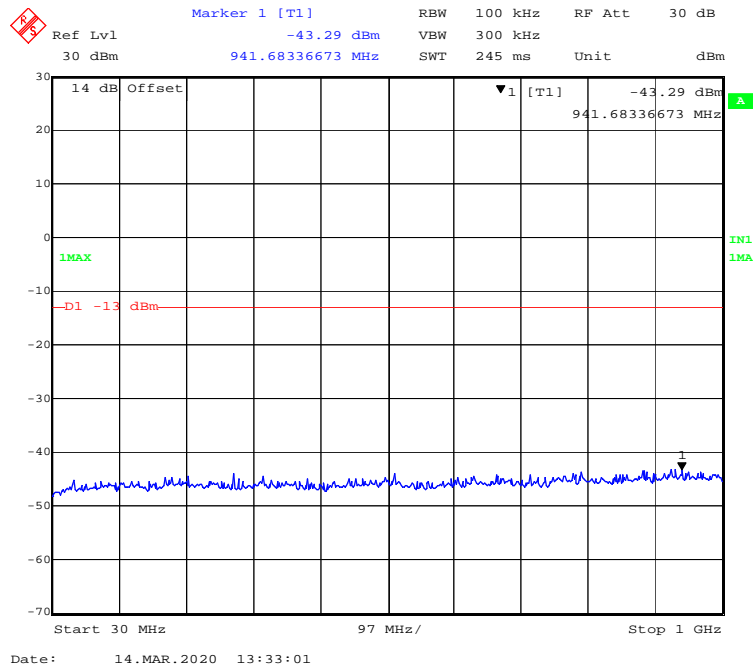


1 GHz – 20 GHz (16QAM, 15.0 MHz, Middle Channel)

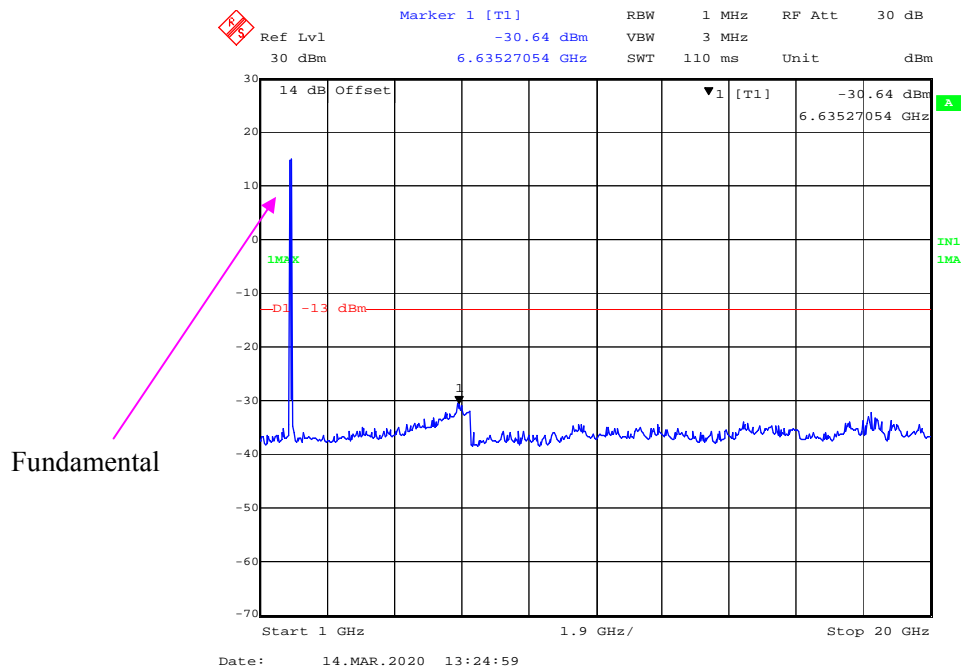


Fundamental

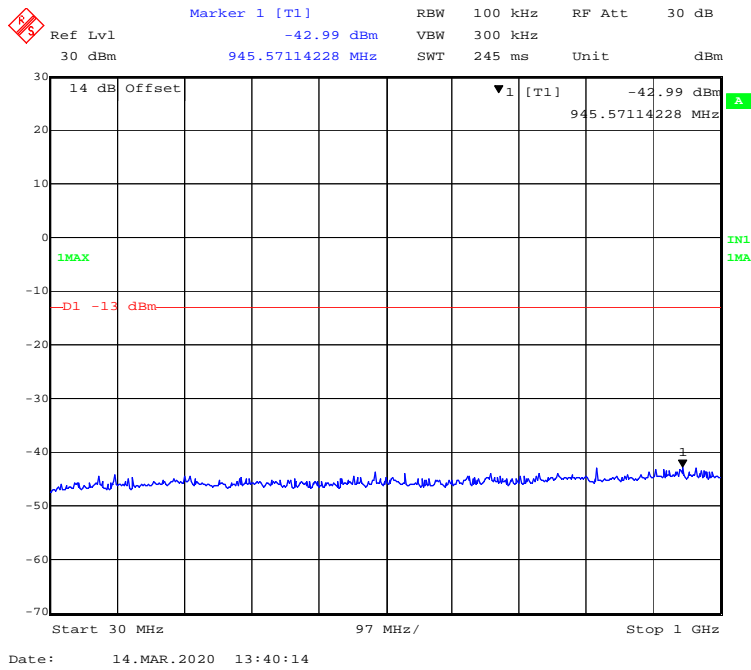
30 MHz - 1 GHz (16QAM, 20.0 MHz, Middle Channel)



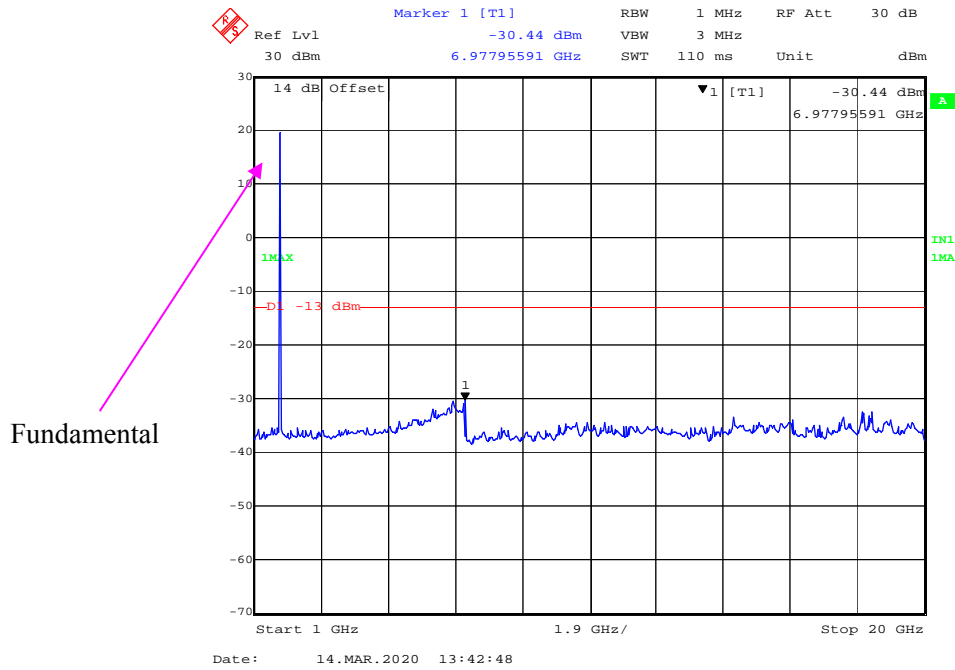
1 GHz – 20 GHz (16QAM, 20.0 MHz, Middle Channel)



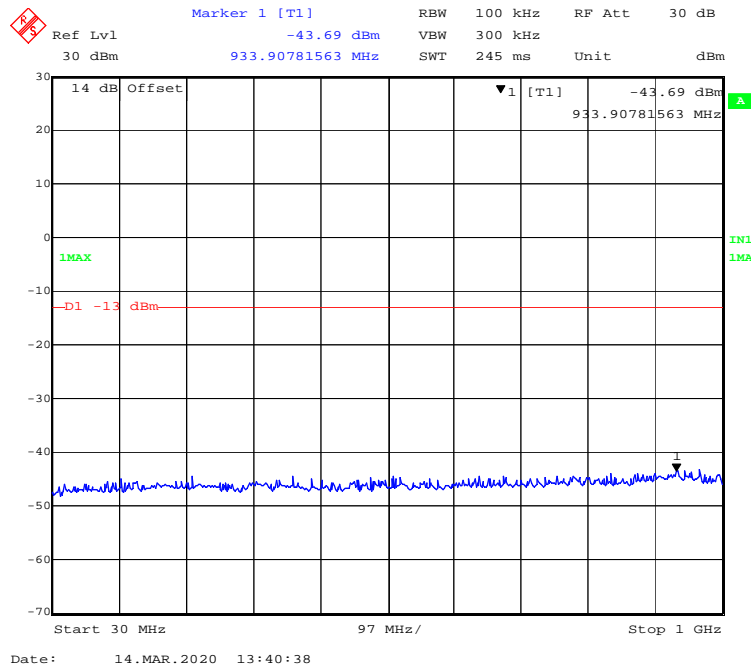
30 MHz - 1 GHz (QPSK, 3.0 MHz, Middle Channel)



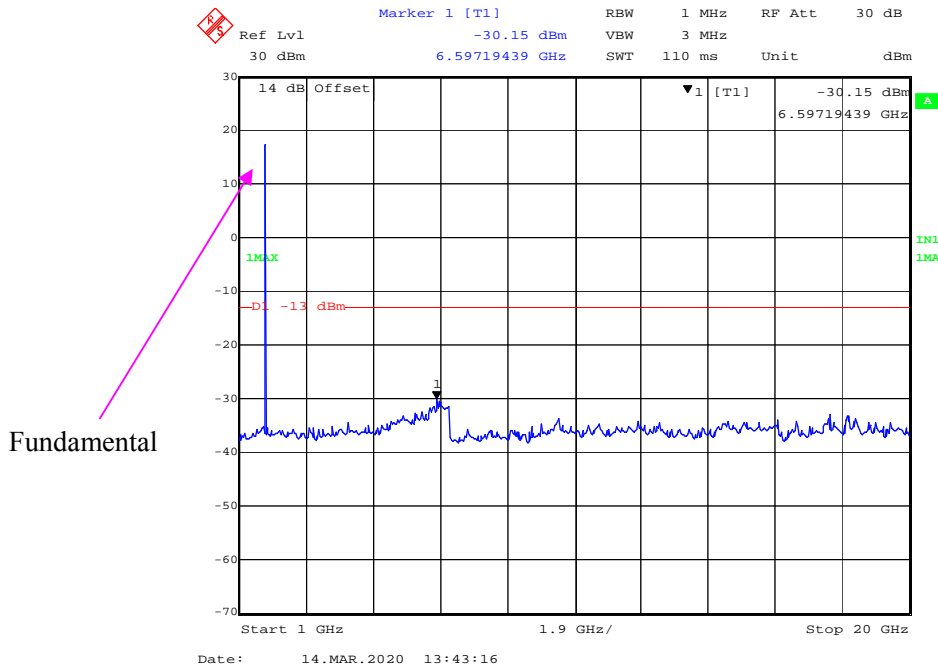
1 GHz - 20 GHz (QPSK, 3.0 MHz, Middle Channel)



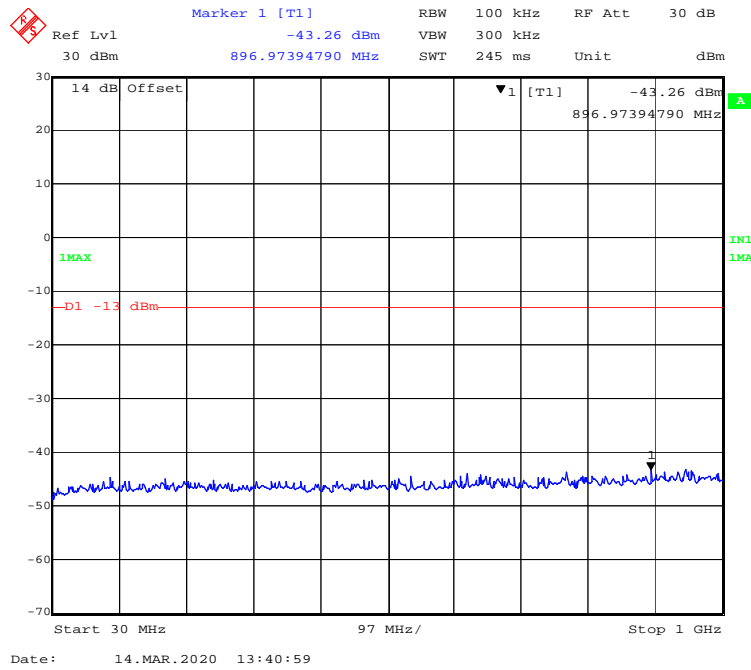
30 MHz - 1 GHz (QPSK, 5.0 MHz, Middle Channel)



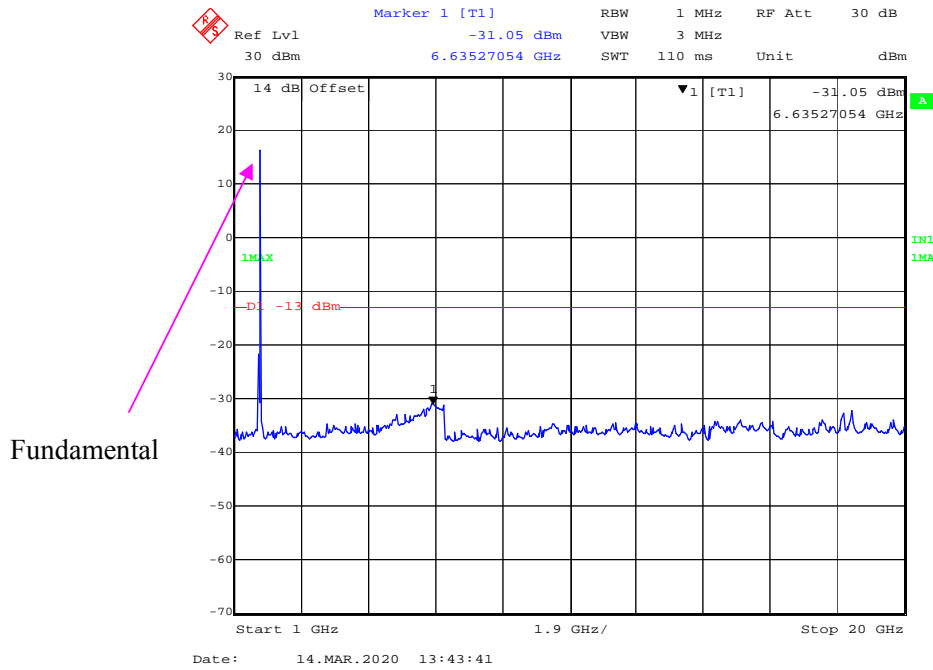
1 GHz – 20 GHz (QPSK, 5.0MHz, Middle Channel)



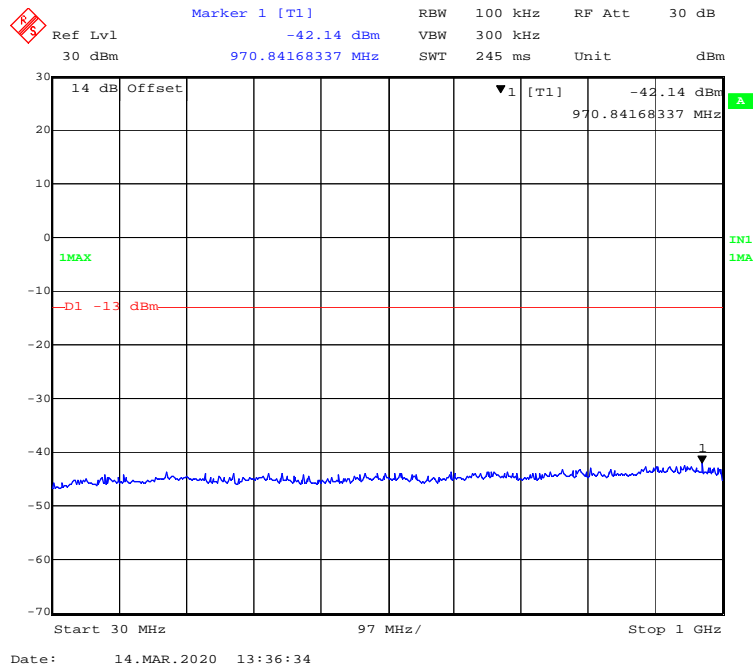
30 MHz - 1 GHz (QPSK, 10.0 MHz, Middle Channel)



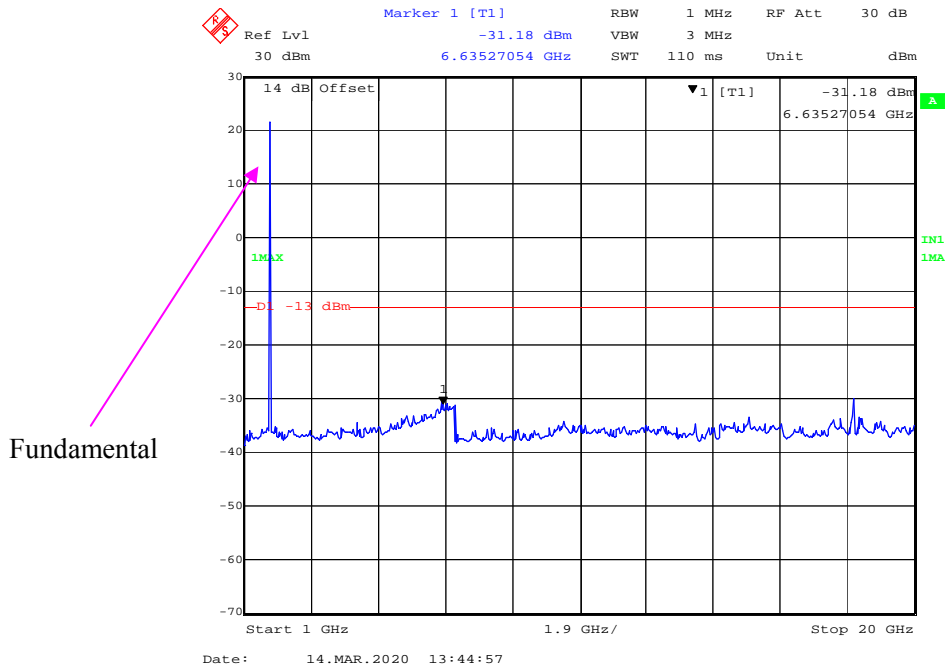
1 GHz - 20 GHz (QPSK, 10.0 MHz, Middle Channel)



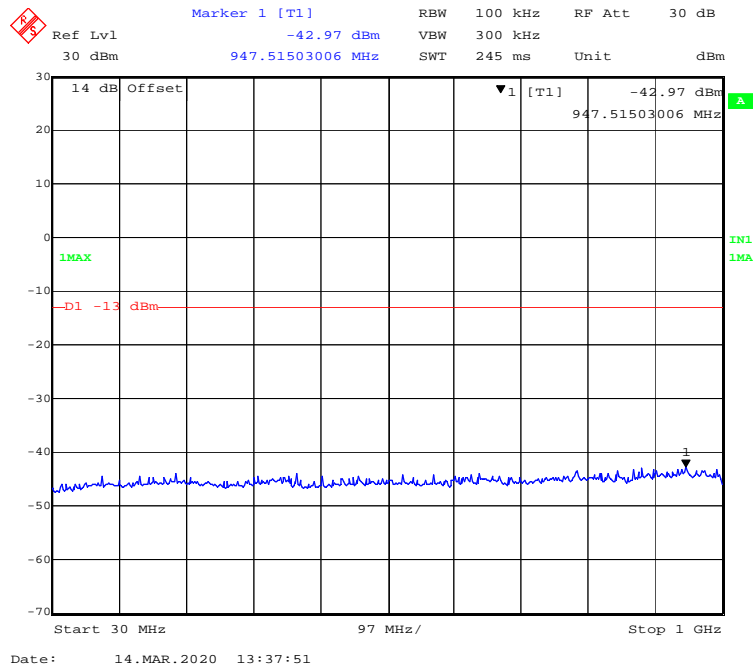
30 MHz - 1 GHz (16QAM, 1.4 MHz, Middle Channel)



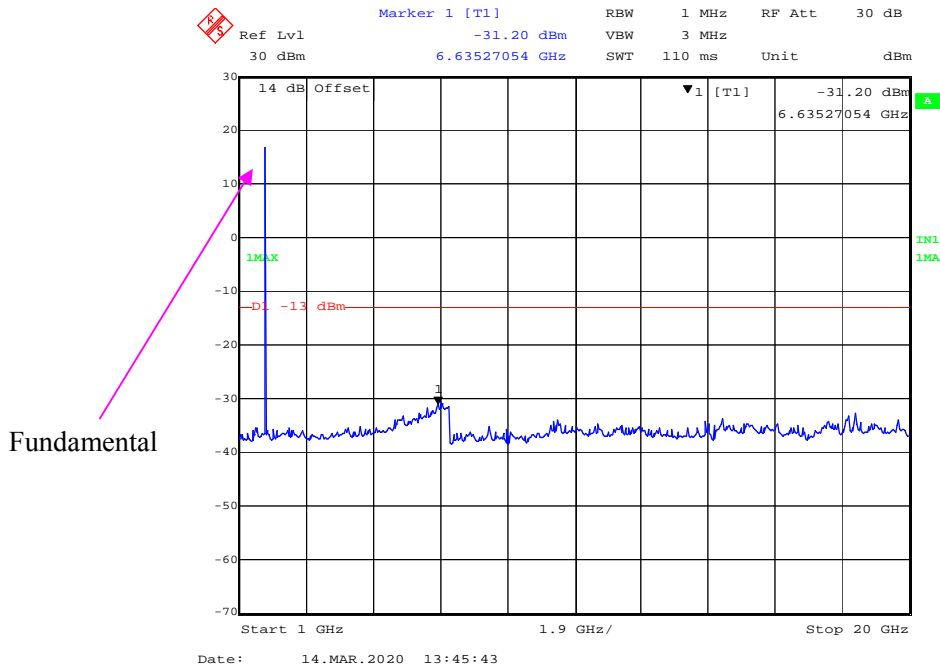
1 GHz – 20 GHz (16QAM, 1.4 MHz, Middle Channel)



30 MHz - 1 GHz (16QAM, 5.0 MHz, Middle Channel)

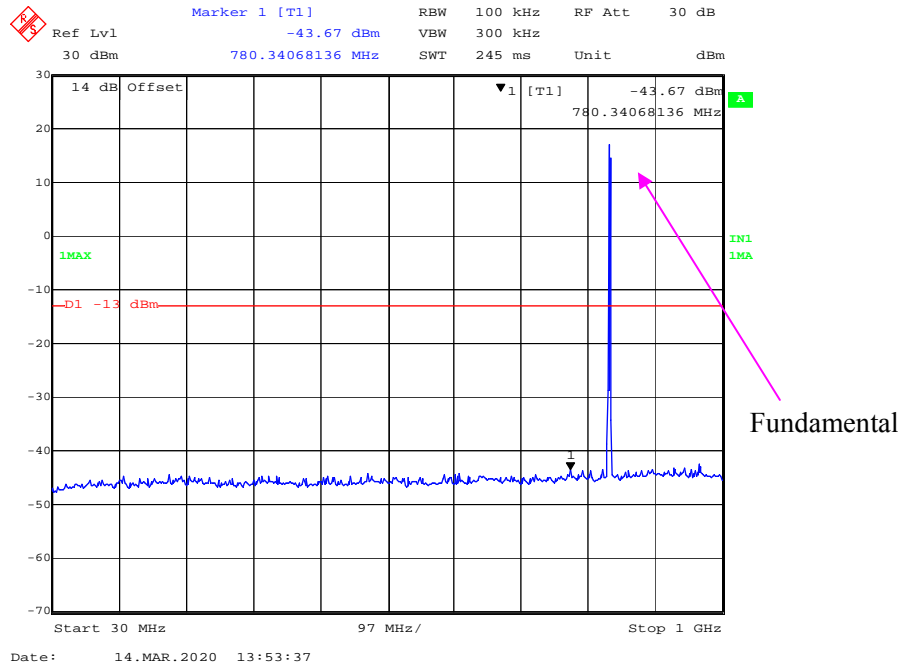


1 GHz – 20 GHz (16QAM, 5.0MHz, Middle Channel)

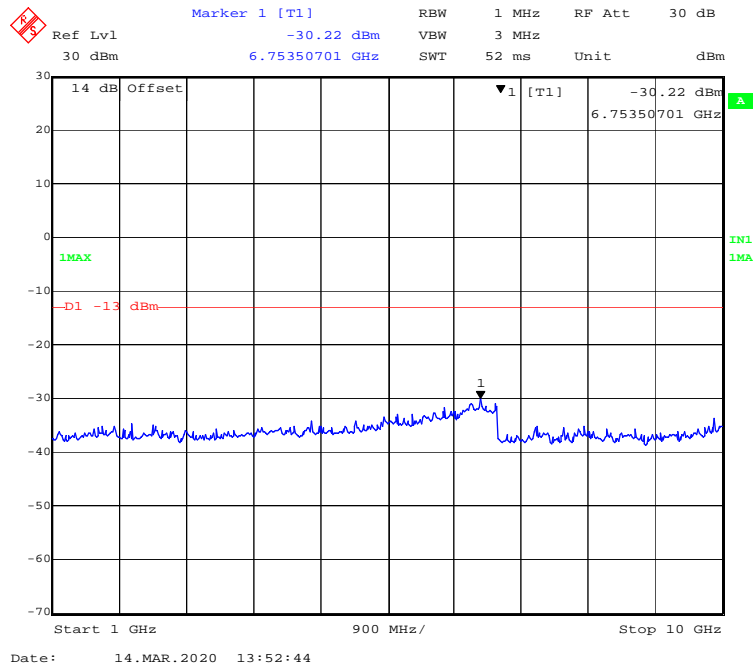


LTE Band 5:

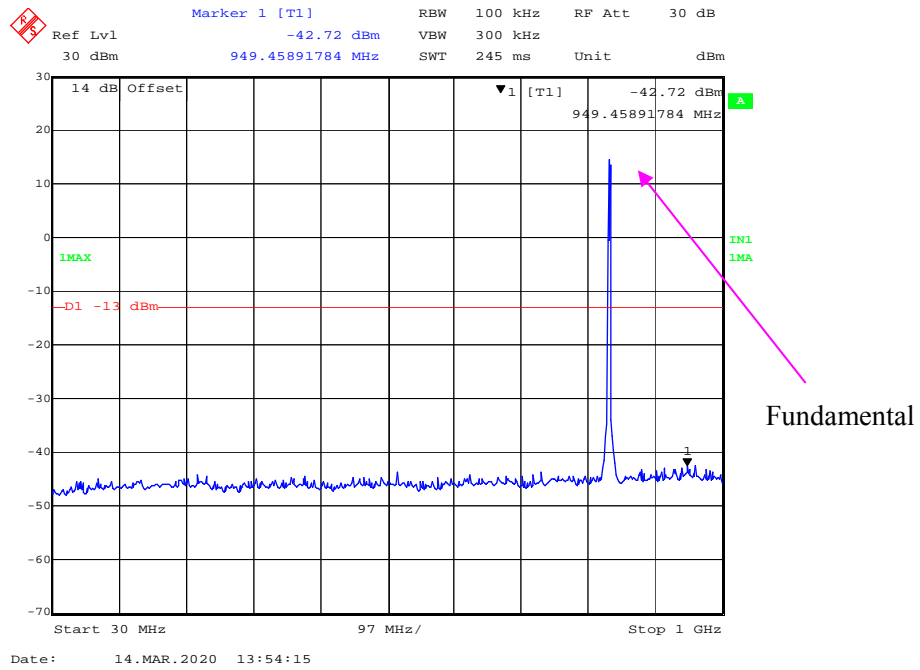
30 MHz - 1 GHz (QPSK, 1.4 MHz, Middle Channel)



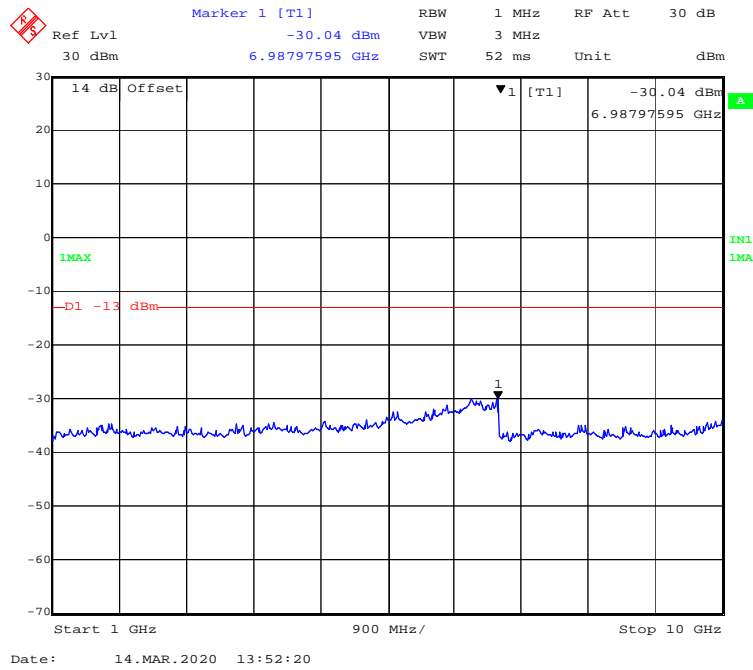
1 GHz – 10 GHz (QPSK, 1.4 MHz, Middle Channel)



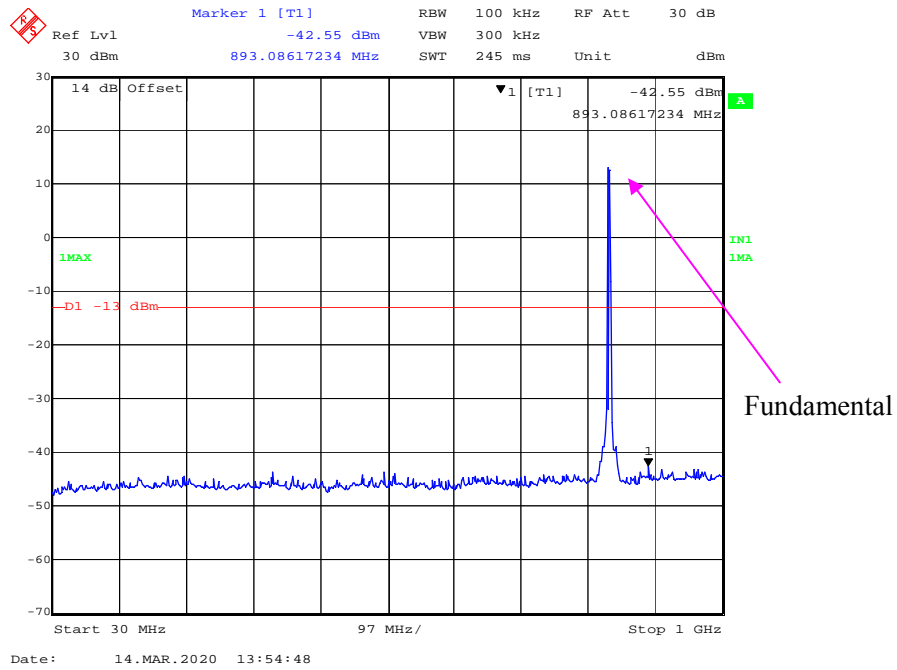
30 MHz - 1 GHz (QPSK, 3.0 MHz, Middle Channel)



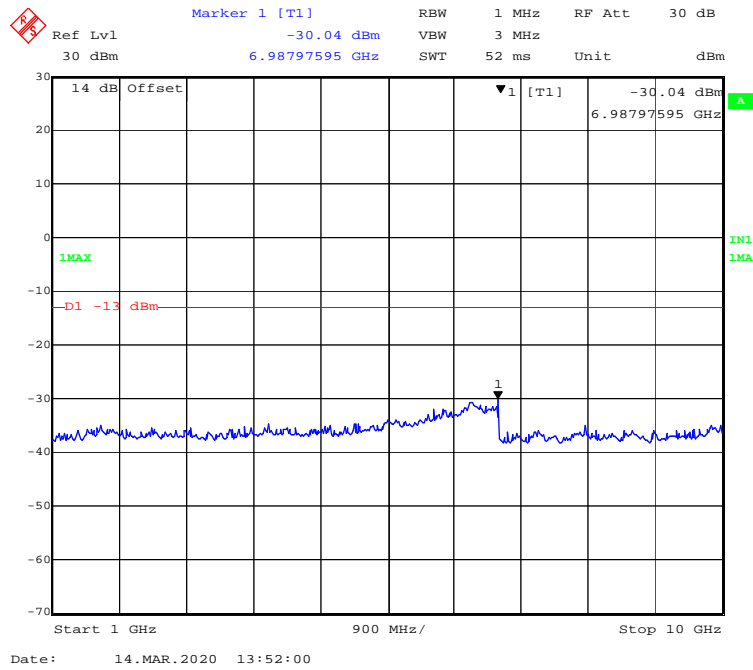
1 GHz – 10 GHz (QPSK, 3.0 MHz, Middle Channel)



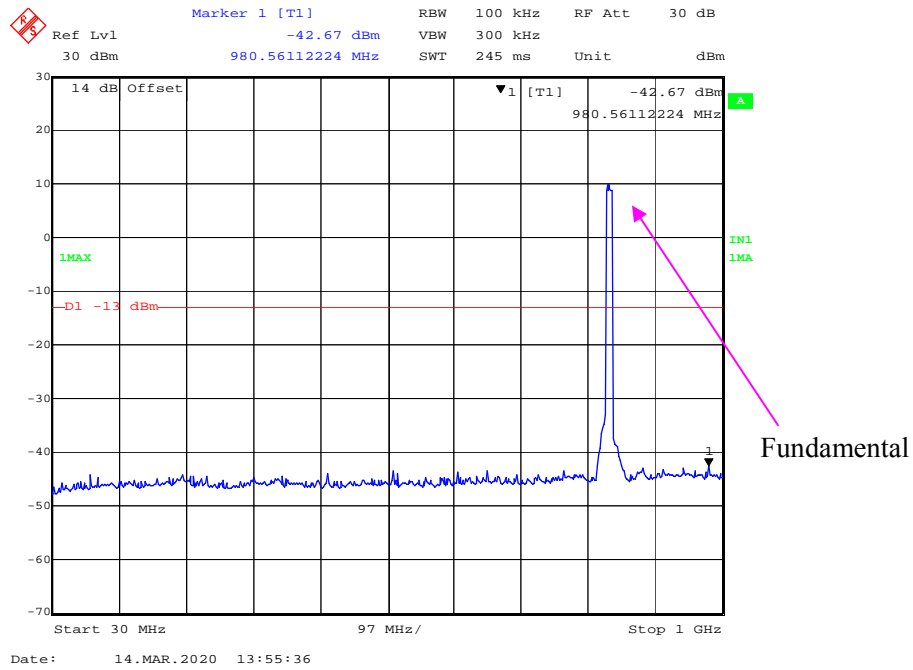
30 MHz - 1 GHz (QPSK, 5.0 MHz, Middle Channel)



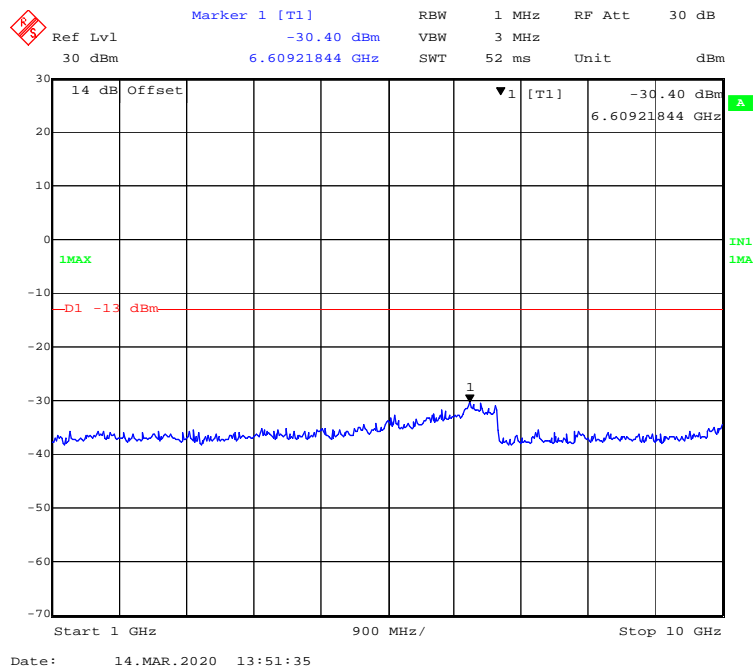
1 GHz – 10 GHz (QPSK, 5.0MHz, Middle Channel)



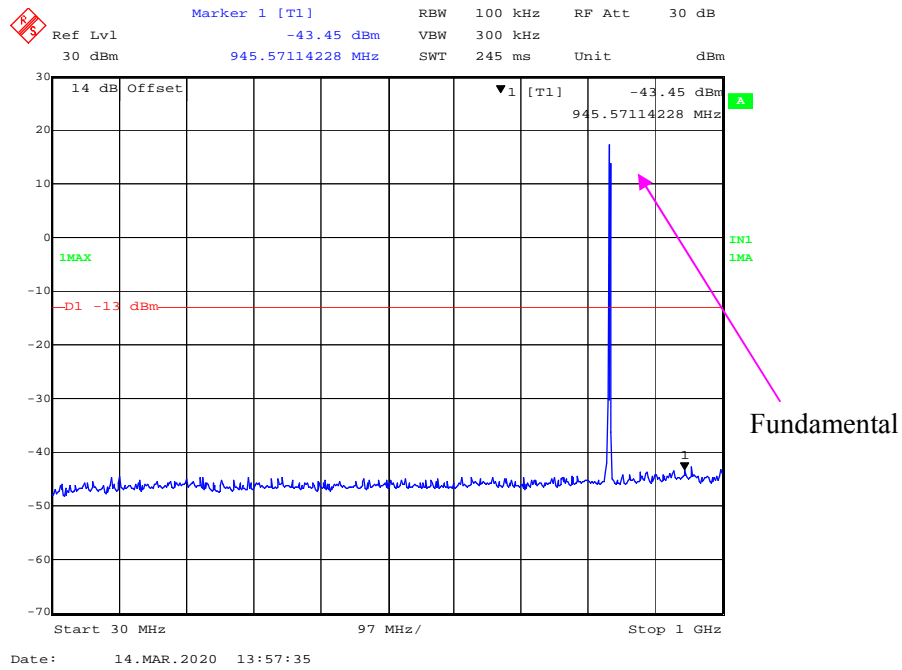
30 MHz - 1 GHz (QPSK, 10.0 MHz, Middle Channel)



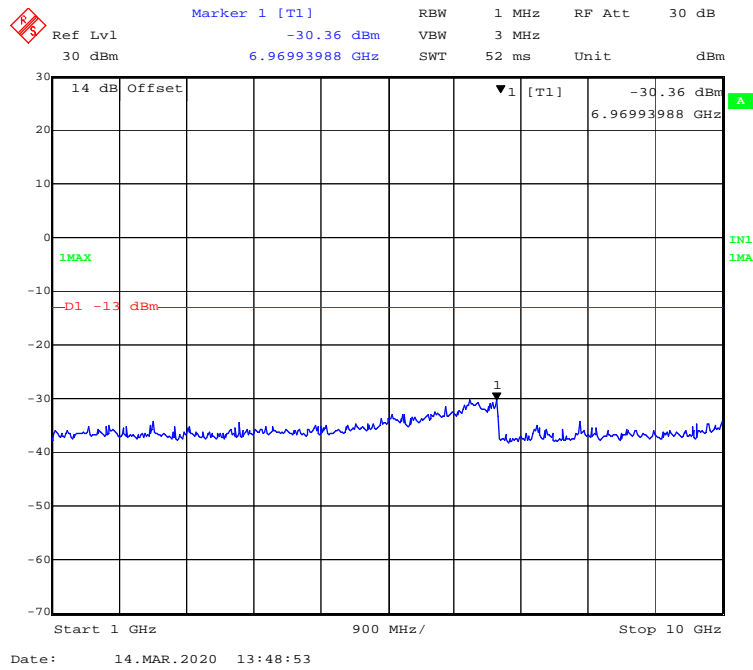
1 GHz – 10 GHz (QPSK, 10.0 MHz, Middle Channel)



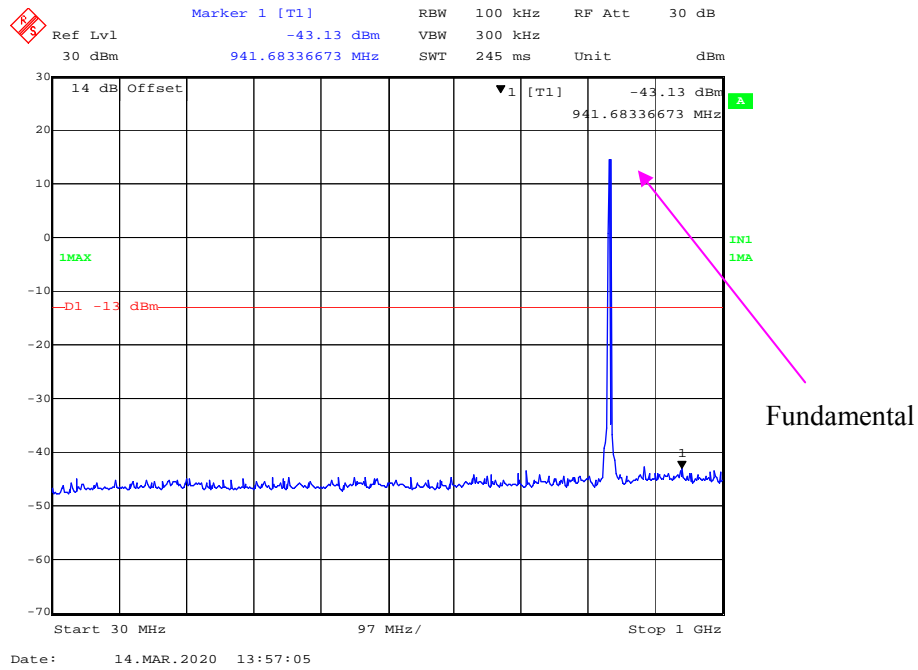
30 MHz - 1 GHz (16QAM, 1.4 MHz, Middle Channel)



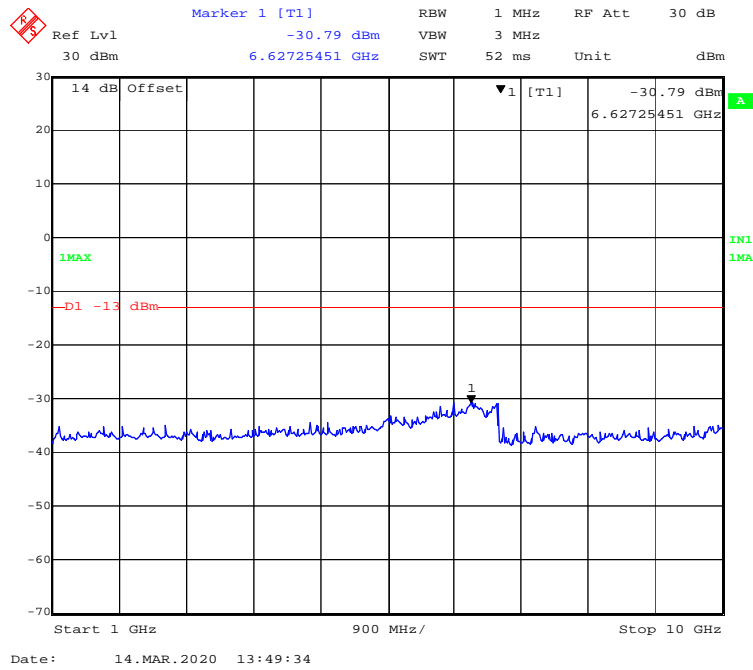
1 GHz – 10 GHz (16QAM, 1.4 MHz, Middle Channel)



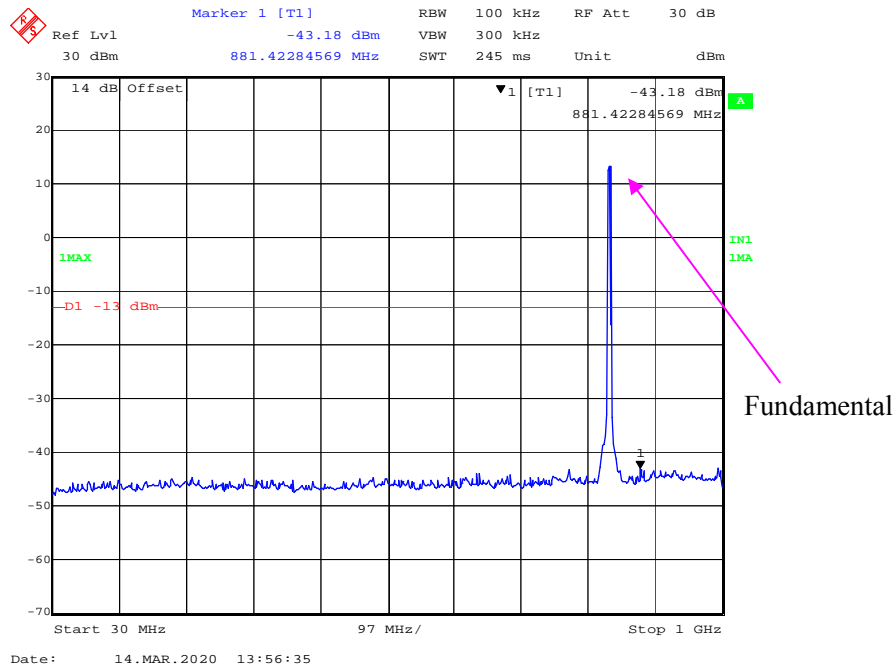
30 MHz - 1 GHz (16QAM, 3.0 MHz, Middle Channel)



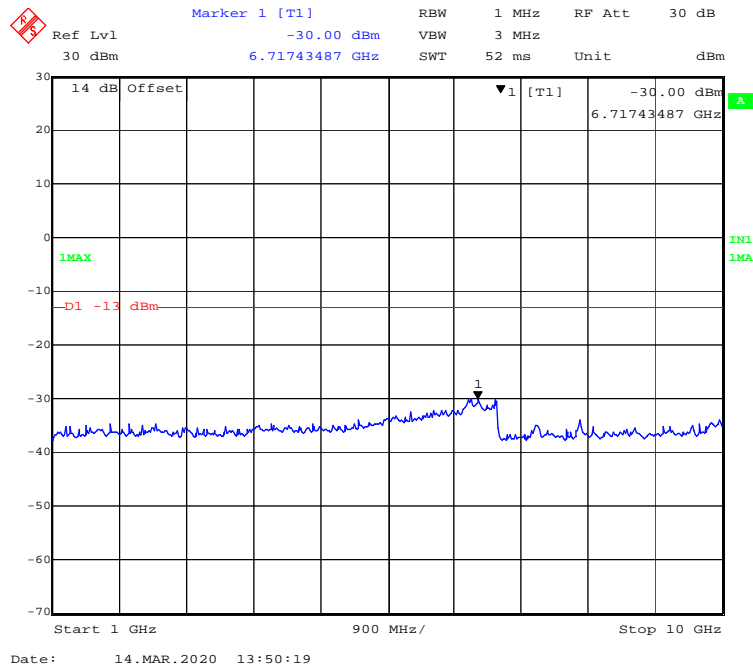
1 GHz – 10 GHz (16QAM, 3.0 MHz, Middle Channel)



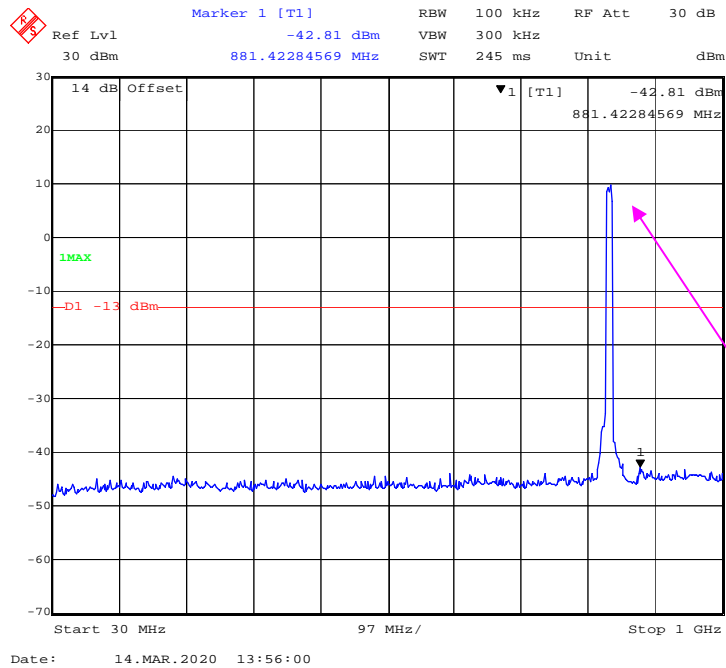
30 MHz - 1 GHz (16QAM, 5.0 MHz, Middle Channel)



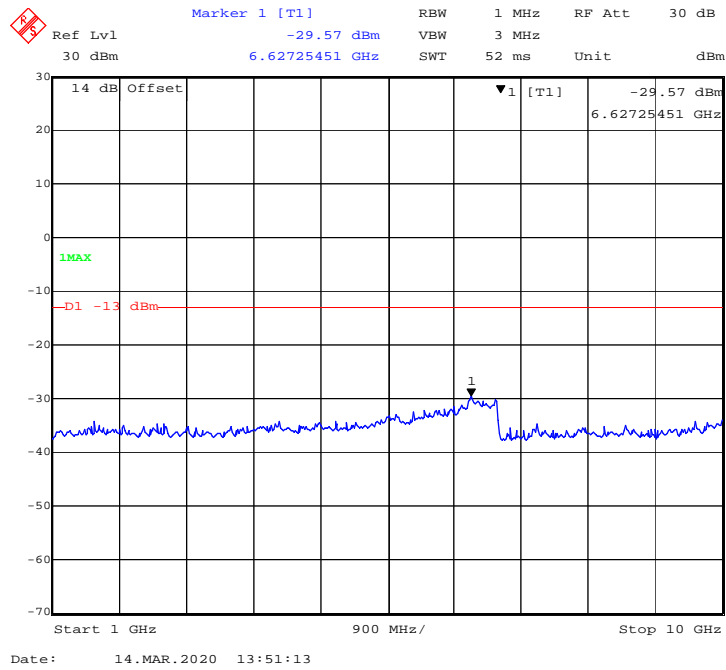
1 GHz – 10 GHz (16QAM, 5.0MHz, Middle Channel)



30 MHz - 1 GHz (16QAM, 10.0 MHz, Middle Channel)



1 GHz – 10 GHz (16QAM, 10.0 MHz, Middle Channel)



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

Applicable Standards

FCC § 2.1053, §22.917(a) and § 24.238(a) and § 27.53(h)

22.917 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

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

27.53(h), for mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz.

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 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.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg (\text{TX pwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \text{Log}_{10} (\text{power out in Watts})$

Test Data

Environmental Conditions

Temperature:	23.2 °C
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

The testing was performed by CK Huang on 2020-03-19.

Test mode: Transmitting (Pre-scan with low, middle and high channels, and the worse case data as below)

30 MHz ~ 10 GHz:

GSM 850 Band

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
GSM Mode, Middle channel										
400.05	54.21	195	210	H	-51.00	0.52	-1.35	-52.87	-13	39.87
400.05	53.18	56	158	V	-52.03	0.52	-1.35	-53.90	-13	40.90
1673.20	49.97	78	125	H	-53.42	0.84	8.48	-45.78	-13	32.78
1673.20	56.23	96	139	V	-47.16	0.84	8.48	-39.52	-13	26.52
2509.80	42.41	86	114	H	-58.53	0.89	10.09	-49.33	-13	36.33
2509.80	49.06	124	175	V	-51.88	0.89	10.09	-42.68	-13	29.68

WCDMA Band V

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
WCDMA Mode, Middle channel										
400.05	59.81	219	143	H	-45.40	0.53	-1.35	-47.28	-13	34.28
400.05	58.62	91	127	V	-46.59	0.53	-1.35	-48.47	-13	35.47
1673.20	56.54	145	104	H	-41.07	0.83	8.20	-33.70	-13	20.70
1673.20	57.16	264	201	V	-40.99	0.83	8.20	-33.62	-13	20.62
2509.80	48.68	339	127	H	-46.91	0.89	10.10	-37.70	-13	24.70
2509.80	49.16	39	156	V	-46.75	0.89	10.10	-37.54	-13	24.54

30 MHz ~ 20 GHz:

PCS 1900 Band

Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
GSM Mode, Middle channel										
400.05	56.02	55	145	H	-49.19	0.32	-6.92	-56.43	-13	43.43
400.05	55.86	302	156	V	-49.35	0.32	-6.92	-56.59	-13	43.59
3760.00	43.84	225	189	H	-52.87	0.95	9.74	-44.08	-13	31.08
3760.00	45.68	110	200	V	-51.03	0.95	9.74	-42.24	-13	29.24
5640.00	41.77	137	155	H	-52.16	1.15	10.74	-42.57	-13	29.57
5640.00	44.14	159	187	V	-49.79	1.15	10.74	-40.20	-13	27.20

WCDMA Band II

Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
WCDMA Mode, Middle channel										
400.05	56.32	118	156	H	-48.89	0.53	-1.35	-50.77	-13	37.77
400.05	57.82	356	141	V	-47.39	0.53	-1.35	-49.27	-13	36.27
3760.00	47.61	245	207	H	-50.06	0.93	9.90	-41.09	-13	28.09
3760.00	48.35	216	162	V	-49.79	0.93	9.90	-40.82	-13	27.82
5640.00	52.37	67	213	H	-41.62	1.14	10.30	-32.46	-13	19.46
5640.00	53.52	304	137	V	-40.51	1.14	10.30	-31.35	-13	18.35

Note:

- 1) Absolute Level (dBm) = Submitted Level (dBm) - Cable loss (dB) + Antenna Gain (dBd/dBi)
- 2) Margin (dB) = Limit (dBm) - Absolute Level (dBm)

Test mode: Transmitting (Pre-scan with all the bandwidth, and worse case as below)

30 MHz ~ 20 GHz:

LTE Band 2:

Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
QPSK 1.4MHz Bandwidth Middle Channel										
400.05	58.39	219	143	H	-46.82	0.53	-1.35	-48.70	-13	35.70
400.05	59.12	91	127	V	-46.09	0.53	-1.35	-47.97	-13	34.97
3760.00	31.03	131	100	H	-66.95	0.95	9.74	-58.16	-13	45.16
3760.00	30.73	117	103	V	-67.25	0.95	9.74	-58.46	-13	45.46
5640.00	25.74	156	205	H	-68.11	1.15	10.47	-58.79	-13	45.79
5640.00	26.26	96	189	V	-67.59	1.15	10.47	-58.27	-13	45.27
16-QAM 1.4MHz Bandwidth Middle Channel										
400.05	59.43	219	179	H	-45.78	0.53	-1.35	-47.66	-13	34.66
400.05	58.67	91	150	V	-46.54	0.53	-1.35	-48.42	-13	35.42
3760.00	30.06	315	200	H	-67.92	0.95	9.74	-59.13	-13	46.13
3760.00	29.73	356	210	V	-68.25	0.95	9.74	-59.46	-13	46.46
5640.00	24.86	121	200	H	-68.99	1.15	10.47	-59.67	-13	46.67
5640.00	25.66	293	256	V	-68.19	1.15	10.47	-58.87	-13	45.87

LTE Band 4:

Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
QPSK 1.4MHz Bandwidth Middle Channel										
400.05	57.67	219	152	H	-47.54	0.53	-1.35	-49.42	-13	36.42
400.05	58.93	91	111	V	-46.28	0.53	-1.35	-48.16	-13	35.16
3465.00	30.68	147	100	H	-68.13	0.93	9.87	-59.19	-13	46.19
3465.00	30.41	13	208	V	-68.40	0.93	9.87	-59.46	-13	46.46
5197.50	28.07	84	100	H	-67.66	1.10	10.30	-58.46	-13	45.46
5197.50	27.74	33	109	V	-67.99	1.10	10.30	-58.79	-13	45.79
16-QAM 1.4MHz Bandwidth Middle Channel										
400.05	58.49	219	150	H	-46.72	0.53	-1.35	-48.60	-13	35.60
400.05	58.17	91	125	V	-47.04	0.53	-1.35	-48.92	-13	35.92
3465.00	31.41	8	200	H	-67.40	0.93	9.87	-58.46	-13	45.46
3465.00	31.47	211	209	V	-67.34	0.93	9.87	-58.40	-13	45.40
5197.50	29.07	301	200	H	-66.66	1.10	10.30	-57.46	-13	44.46
5197.50	29.17	285	336	V	-66.56	1.10	10.30	-57.36	-13	44.36

LTE Band 5:

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
QPSK 1.4MHz Bandwidth Middle Channel										
400.05	58.91	219	150	H	-46.30	0.53	-1.35	-48.18	-13	35.18
400.05	58.38	91	177	V	-46.83	0.53	-1.35	-48.71	-13	35.71
1673.00	36.77	186	200	H	-68.76	0.84	8.48	-61.12	-13	48.12
1673.00	35.43	246	261	V	-70.10	0.84	8.48	-62.46	-13	49.46
2509.50	32.96	328	100	H	-68.99	0.89	10.09	-59.79	-13	46.79
2509.50	32.62	325	302	V	-69.33	0.89	10.09	-60.13	-13	47.13
16-QAM 1.4MHz Bandwidth Middle Channel										
400.05	58.16	219	150	H	-47.05	0.53	-1.35	-48.93	-13	35.93
400.05	57.34	91	204	V	-47.87	0.53	-1.35	-49.75	-13	36.75
1673.00	37.43	221	200	H	-68.10	0.84	8.48	-60.46	-13	47.46
1673.00	37.10	290	350	V	-68.43	0.84	8.48	-60.79	-13	47.79
2509.50	33.62	177	100	H	-68.33	0.89	10.09	-59.13	-13	46.13
2509.50	33.29	337	142	V	-68.66	0.89	10.09	-59.46	-13	46.46

Note:

- 1) Absolute Level (dBm) = Submitted Level (dBm) - Cable loss (dB) + Antenna Gain (dBd/dBi)
- 2) Margin (dB) = Limit (dBm) - Absolute Level (dBm)

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

Applicable Standards

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.

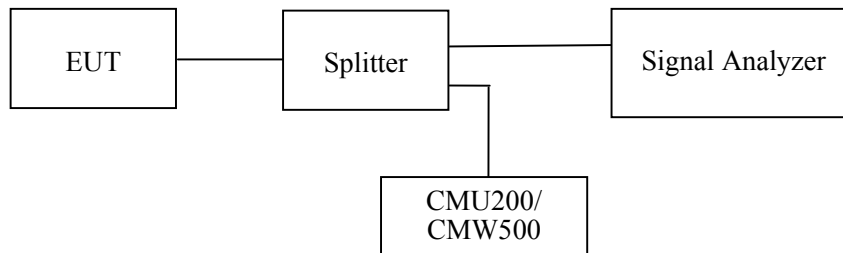
According to FCC §27.53 (h), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz.

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.



Test Data

Environmental Conditions

Temperature:	23.2 °C
Relative Humidity:	51 %
ATM Pressure:	101.1 kPa

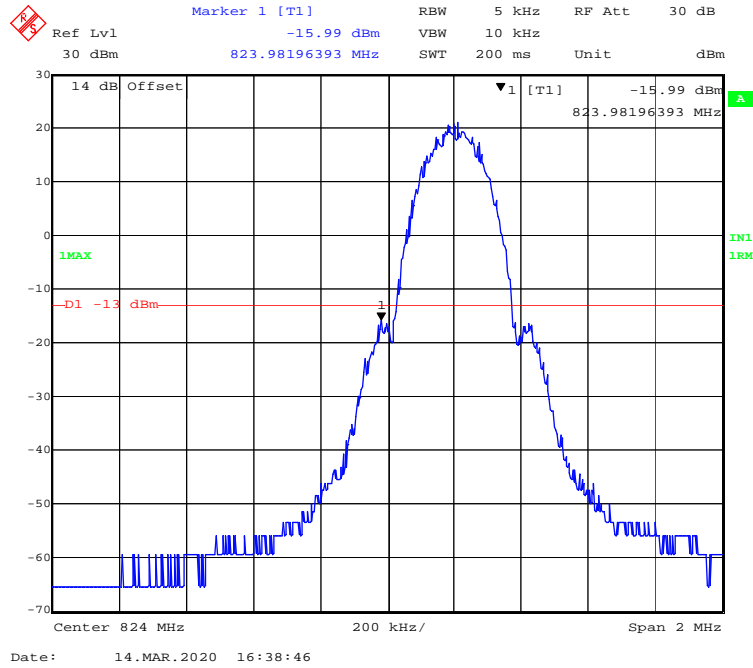
The testing was performed by CK Huang on 2020-03-14.

EUT operation mode: Transmitting

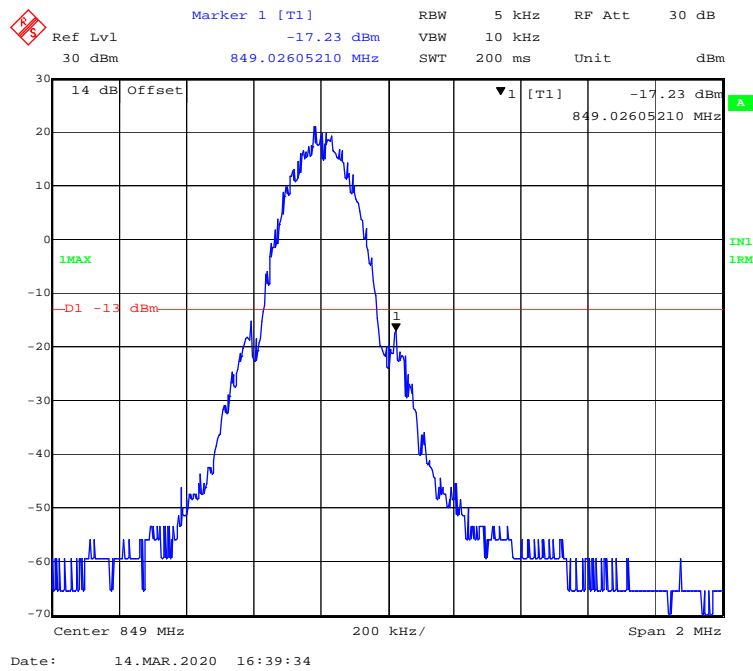
Test Result: Compliant.

GSM 850 Band:

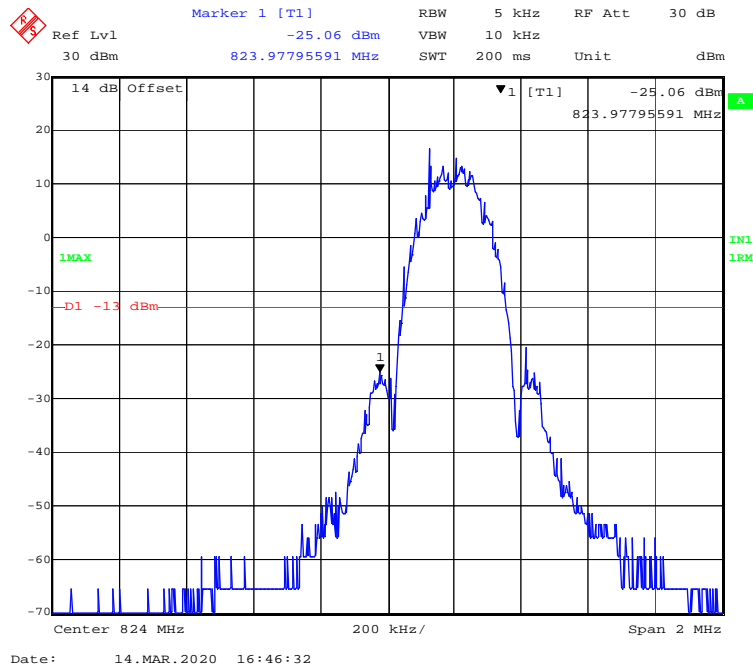
GPRS Mode, Left Band Edge



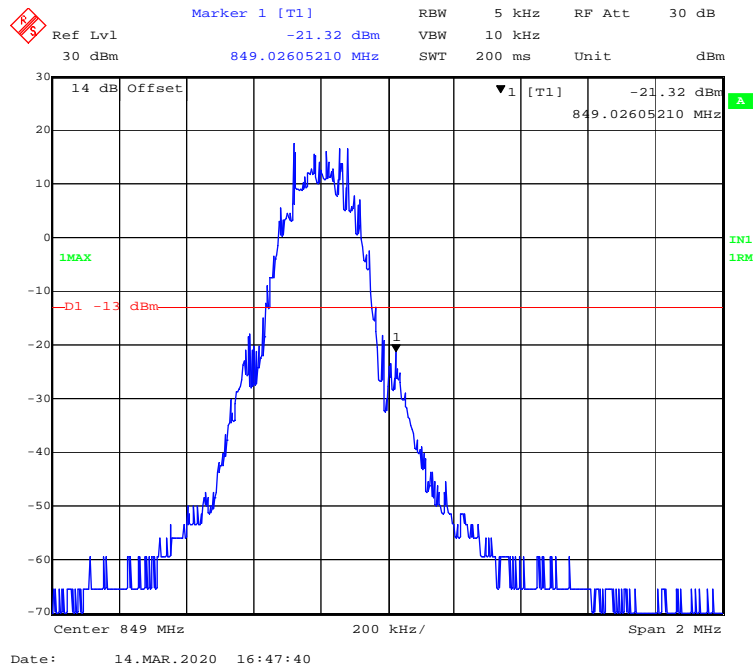
GPRS Mode, Right Band Edge



EGPRS Mode, Left Band Edge

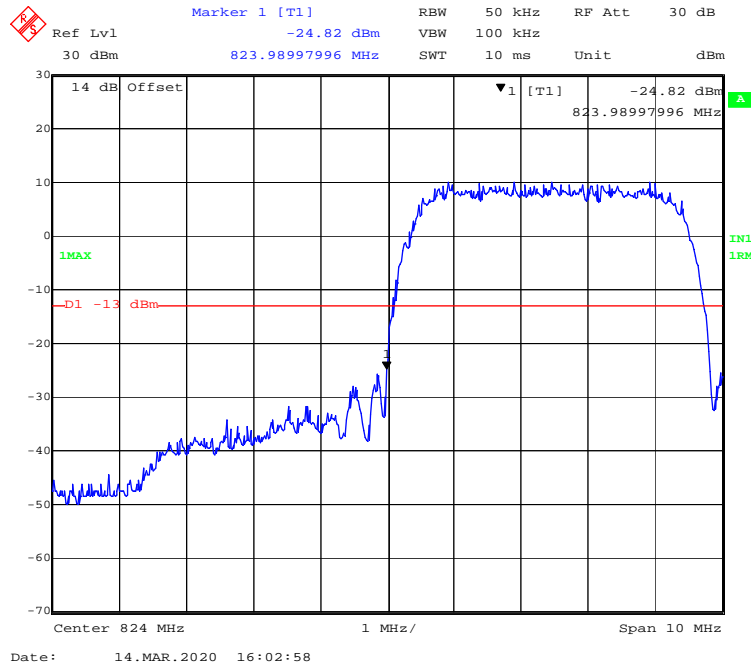


EGPRS Mode, Right Band Edge

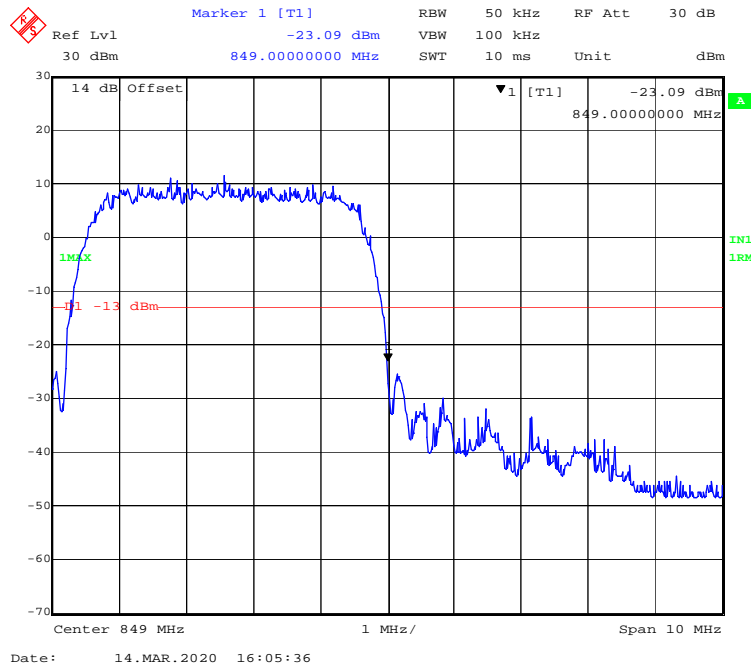


WCDMA Band V

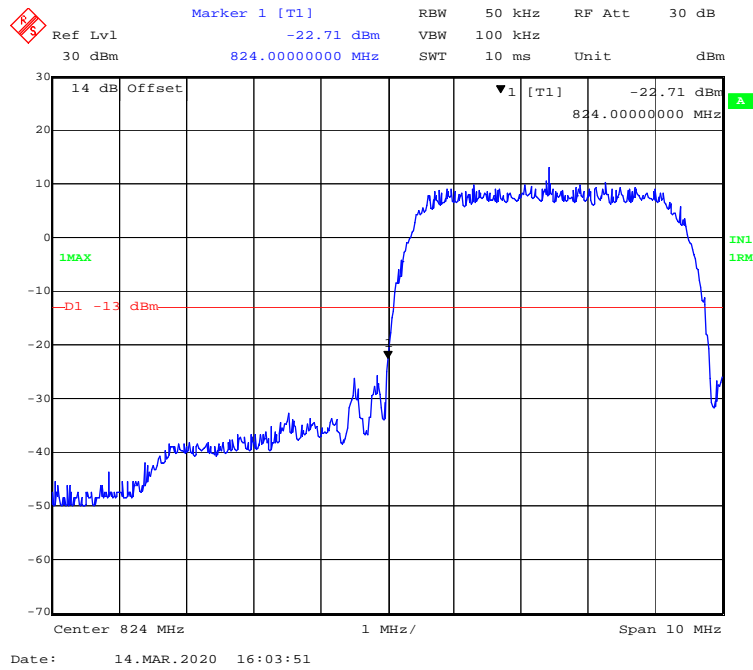
WCDMA (Rel 99) Mode, Left Band Edge



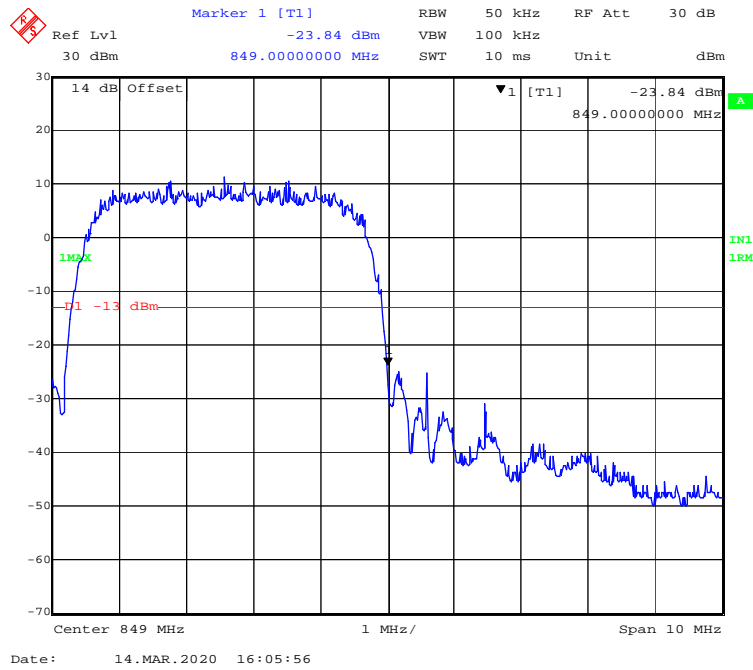
WCDMA (Rel 99) Mode, Right Band Edge



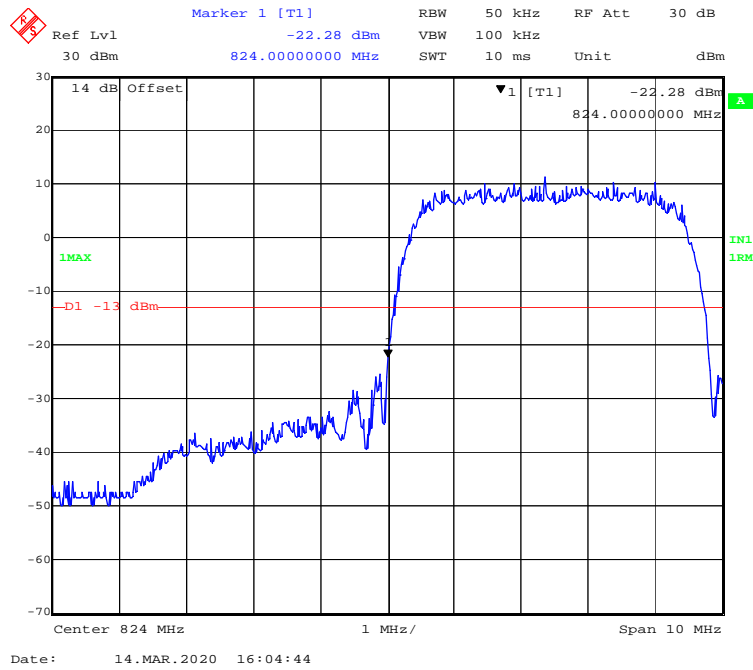
WCDMA (HSDPA) Mode, Left Band Edge



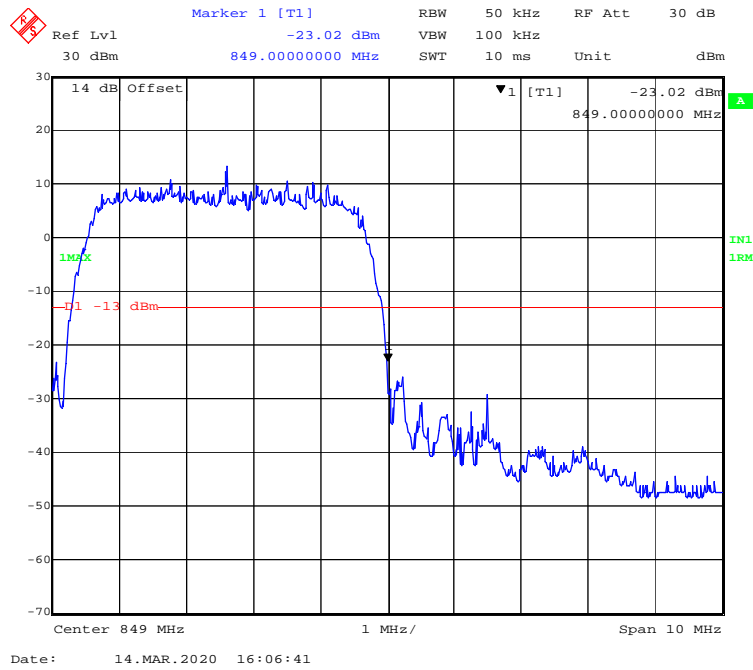
WCDMA (HSDPA) Mode, Right Band Edge



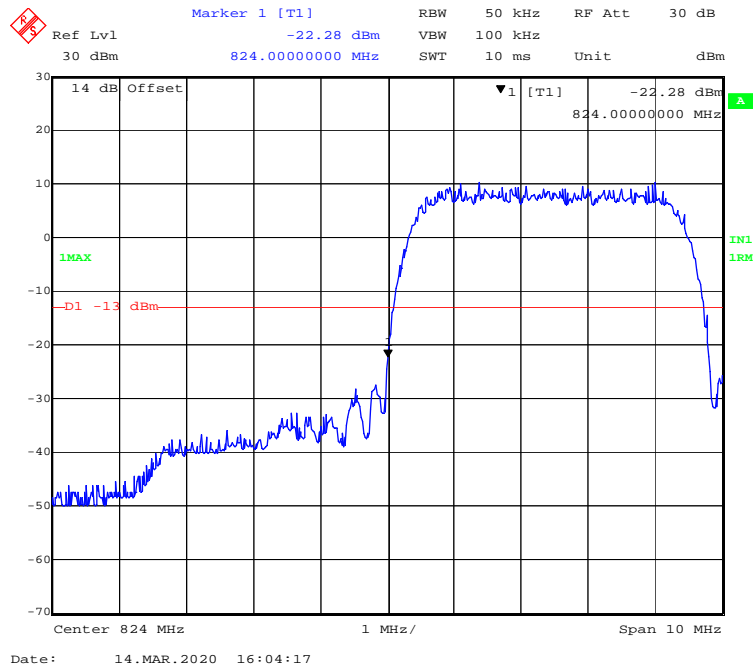
WCDMA (HSUPA) Mode, Left Band Edge



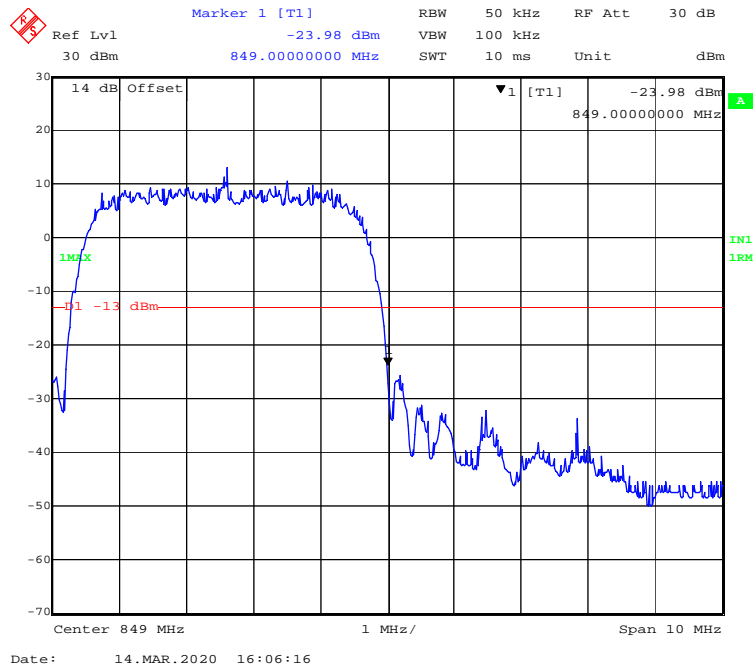
WCDMA (HSUPA) Mode, Right Band Edge



WCDMA (HSPA+) Mode, Left Band Edge

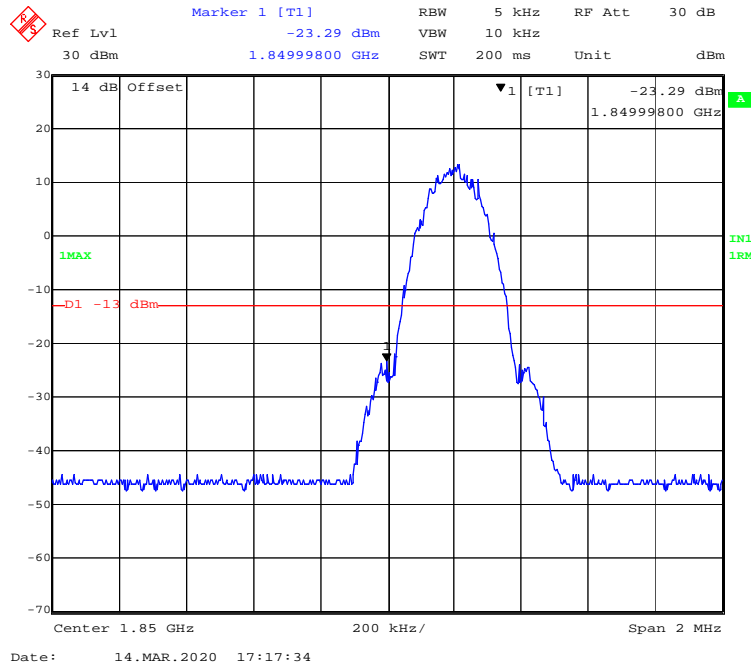


WCDMA (HSPA+) Mode, Right Band Edge

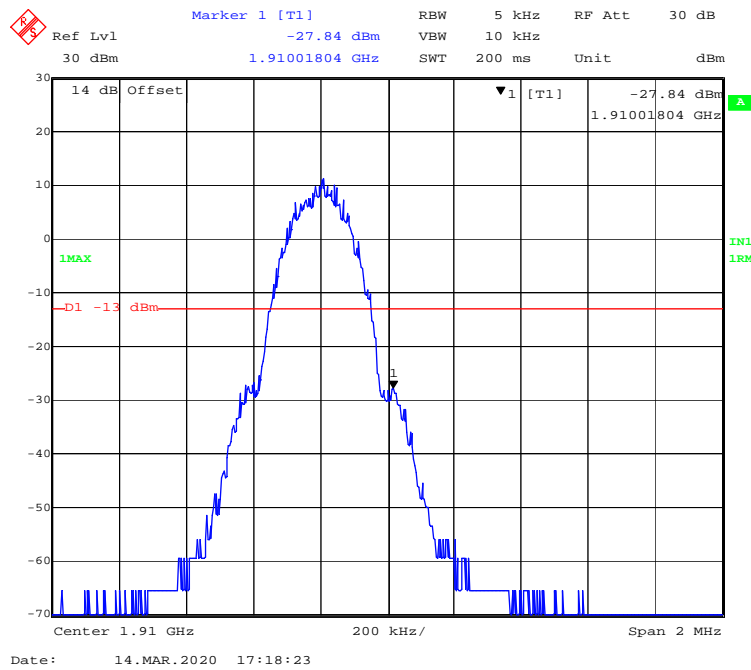


PCS 1900 Band:

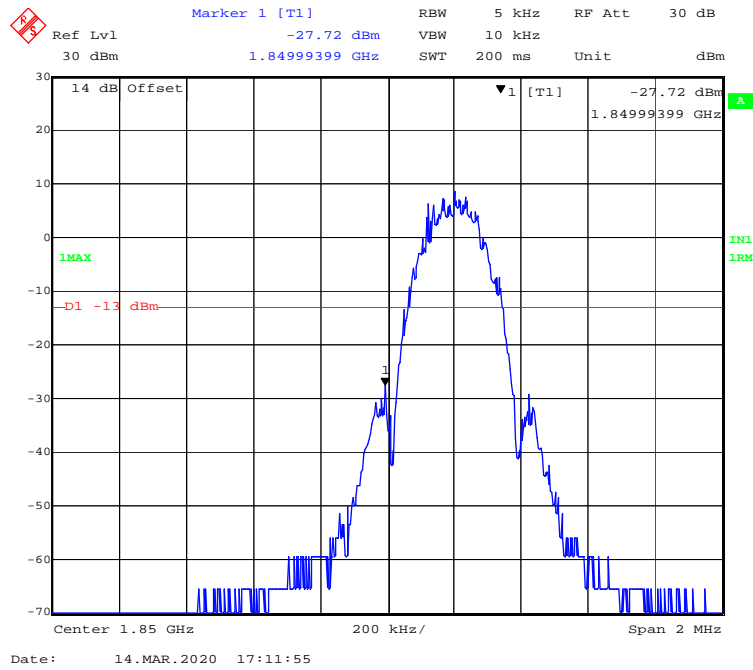
GPRS Mode, Left Band Edge



GPRS Mode, Right Band Edge



EGPRS Mode, Left Band Edge

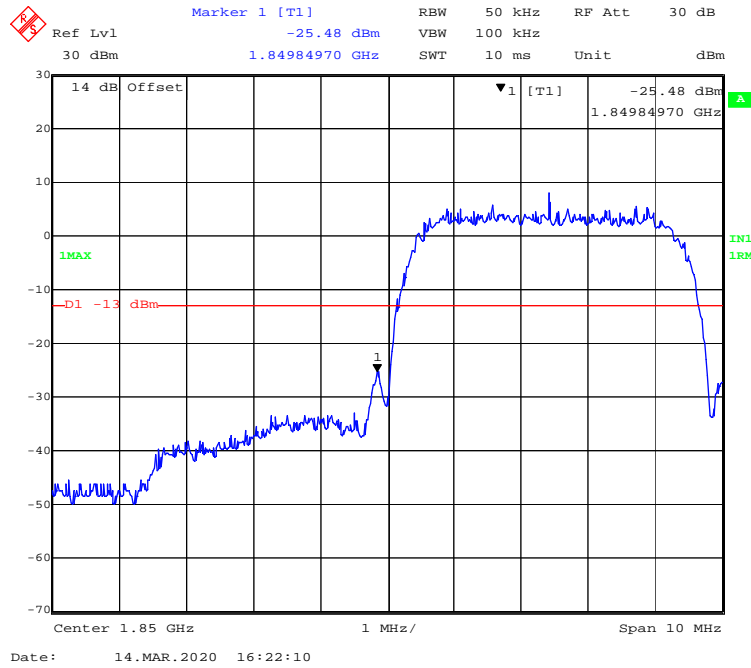


EGPRS Mode, Right Band Edge

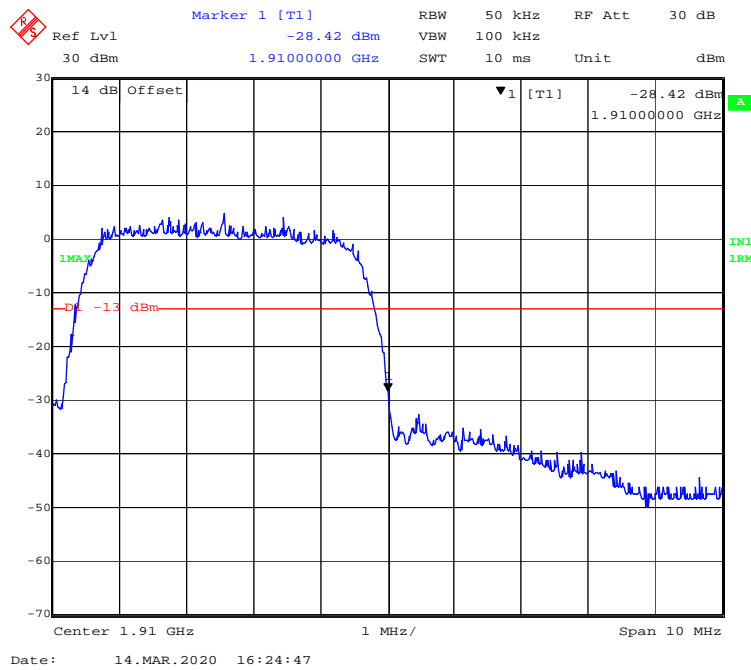


WCDMA Band II

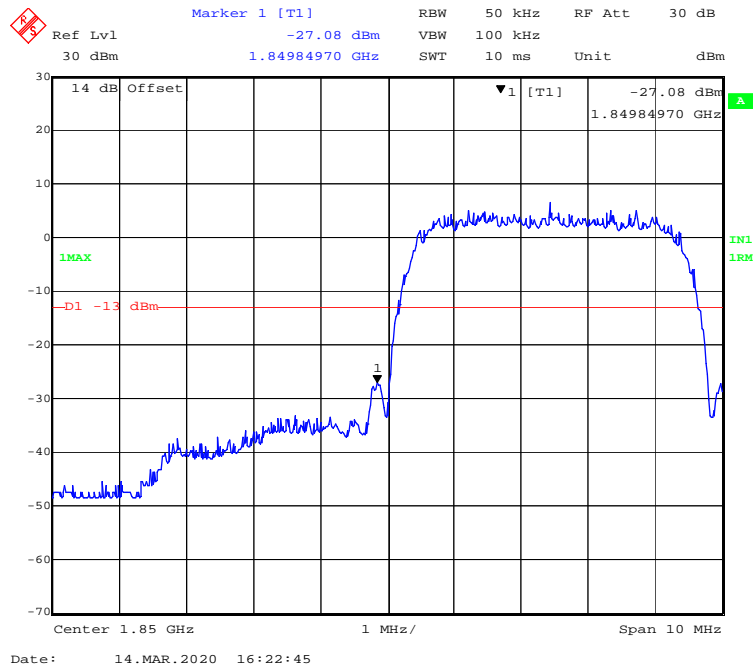
WCDMA (Rel99) Mode, Left Band Edge



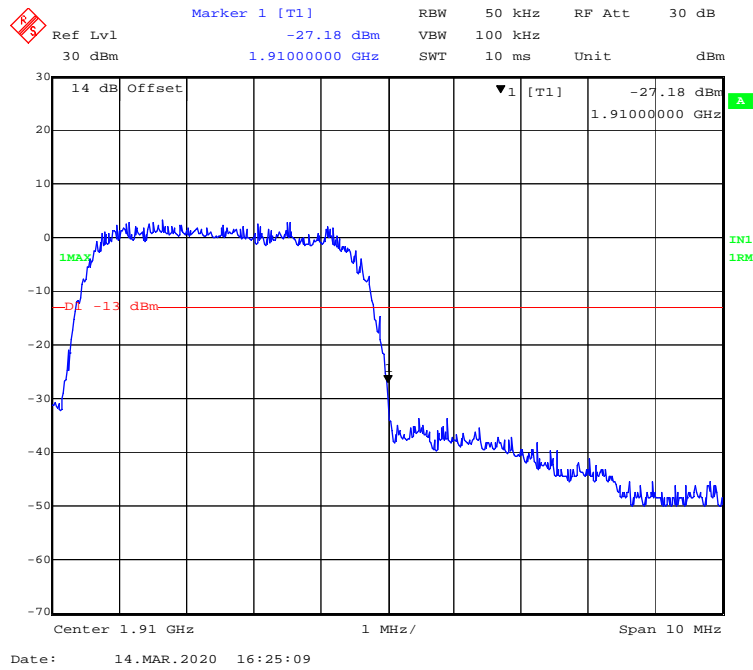
WCDMA (Rel99) Mode, Right Band Edge



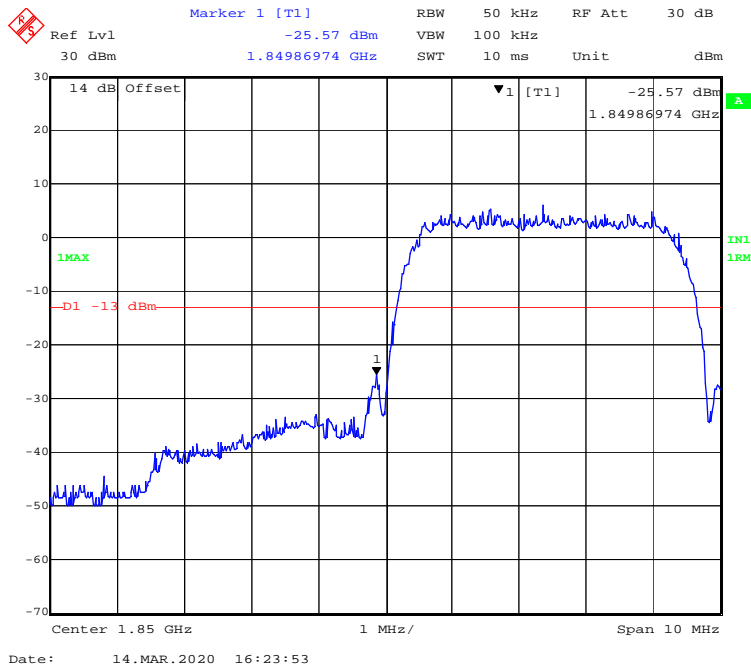
WCDMA (HSDPA) Mode, Left Band Edge



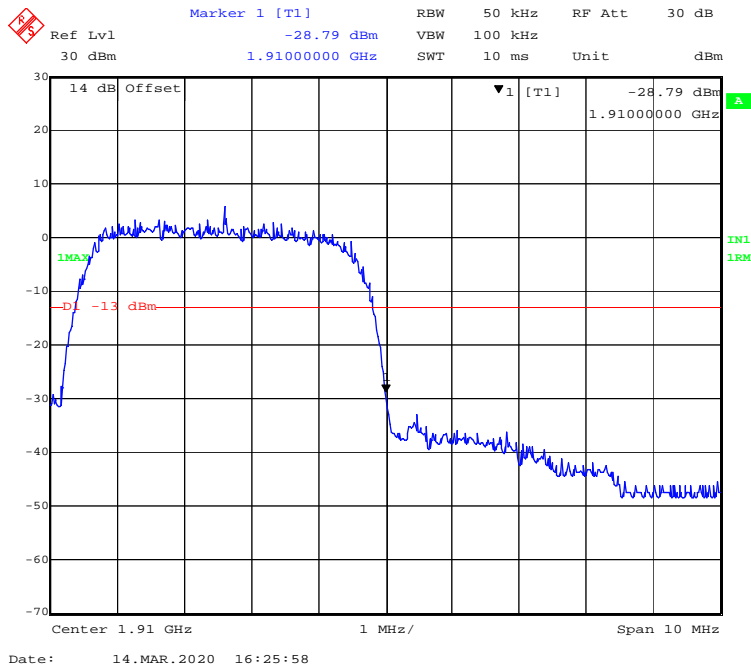
WCDMA (HSDPA) Mode, Right Band Edge



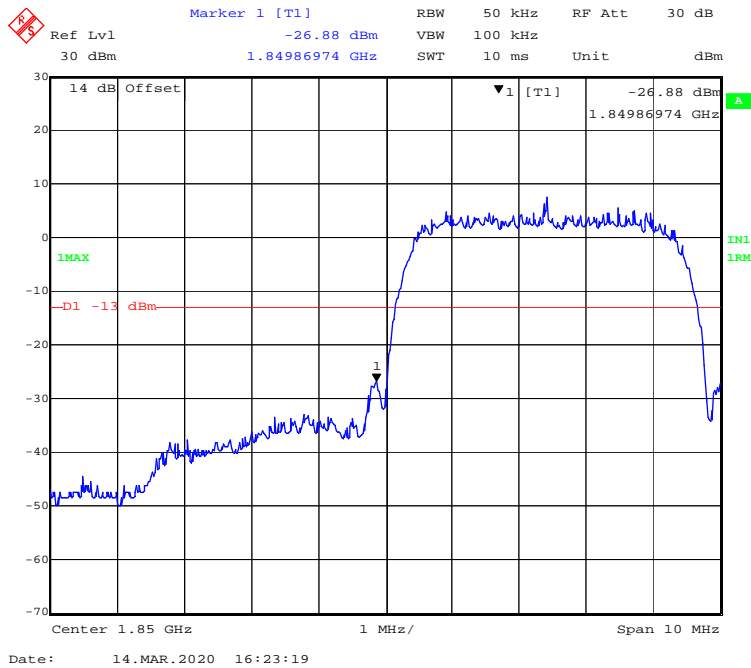
WCDMA (HSUPA) Mode, Left Band Edge



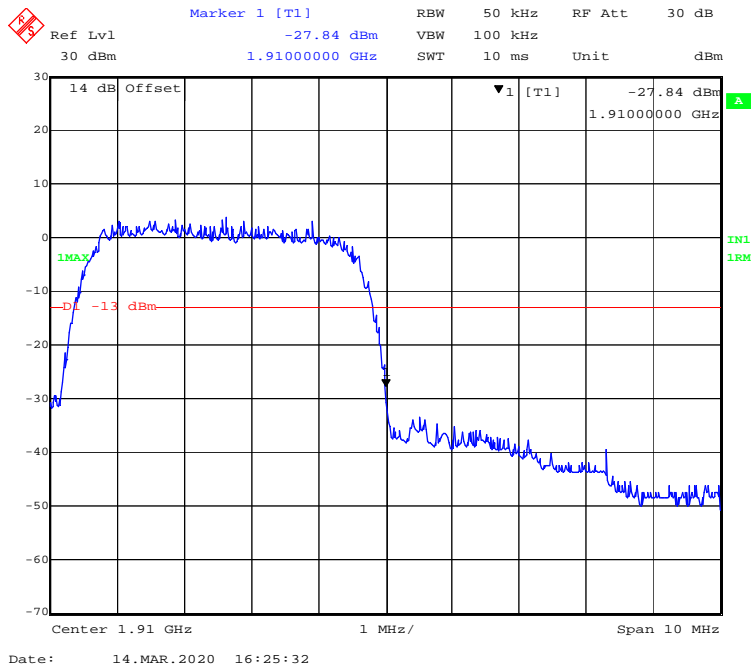
WCDMA (HSUPA) Mode, Right Band Edge



WCDMA (HSPA+) Mode, Left Band Edge

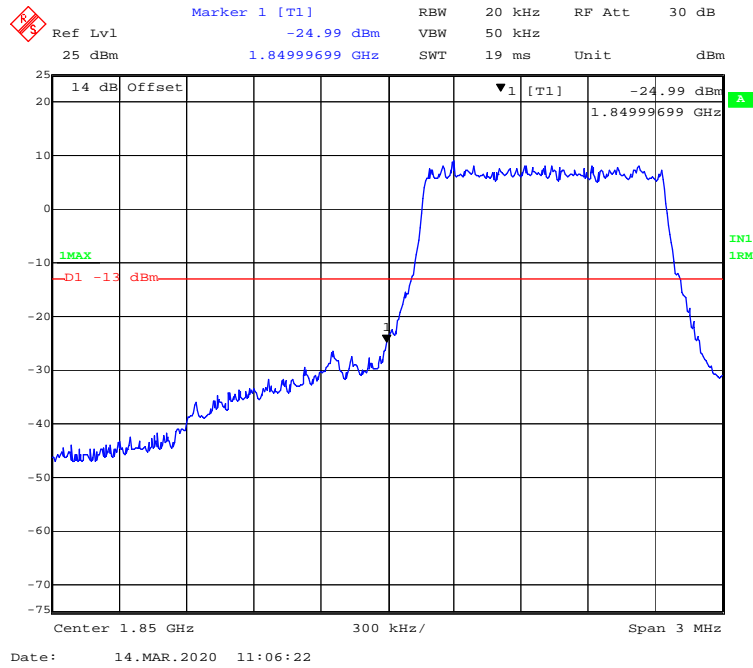


WCDMA (HSPA+) Mode, Right Band Edge

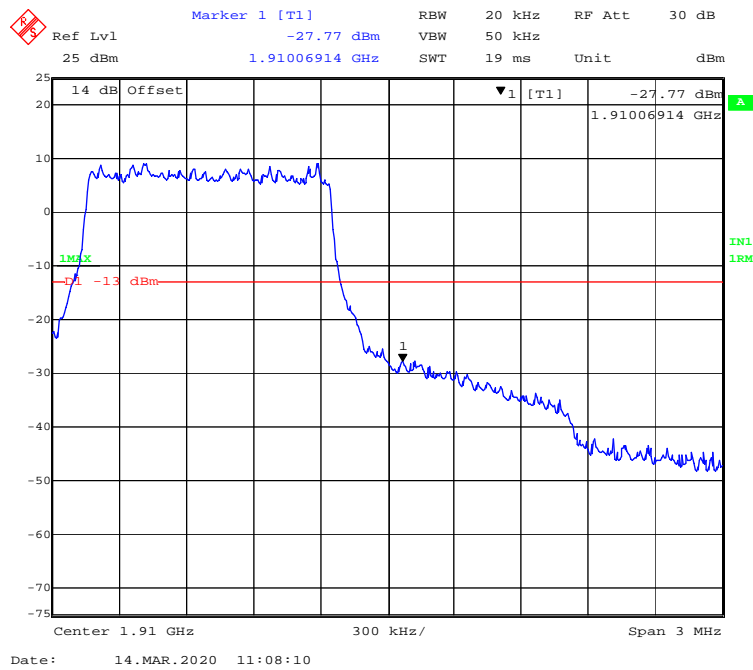


LTE Band 2:

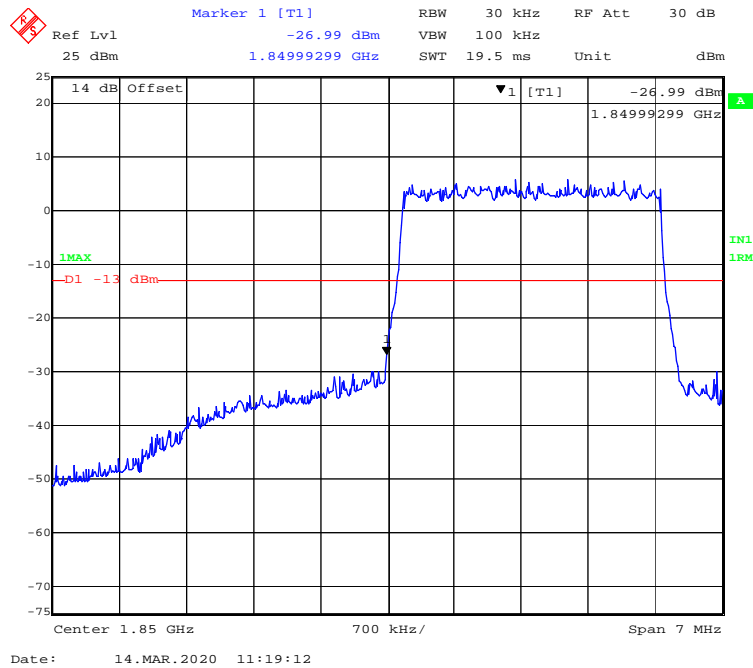
QPSK (1.4 MHz, FULL RB) - Left Band Edge



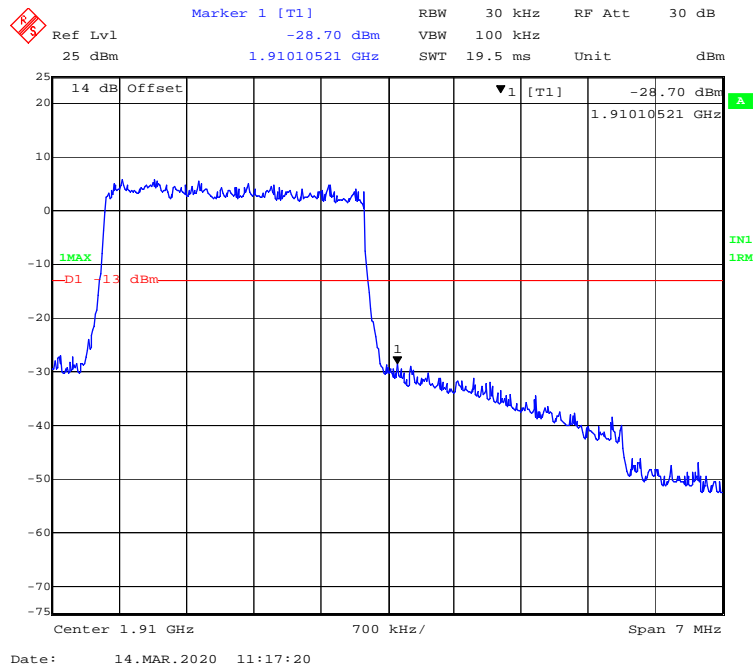
QPSK (1.4 MHz, FULL RB) - Right Band Edge



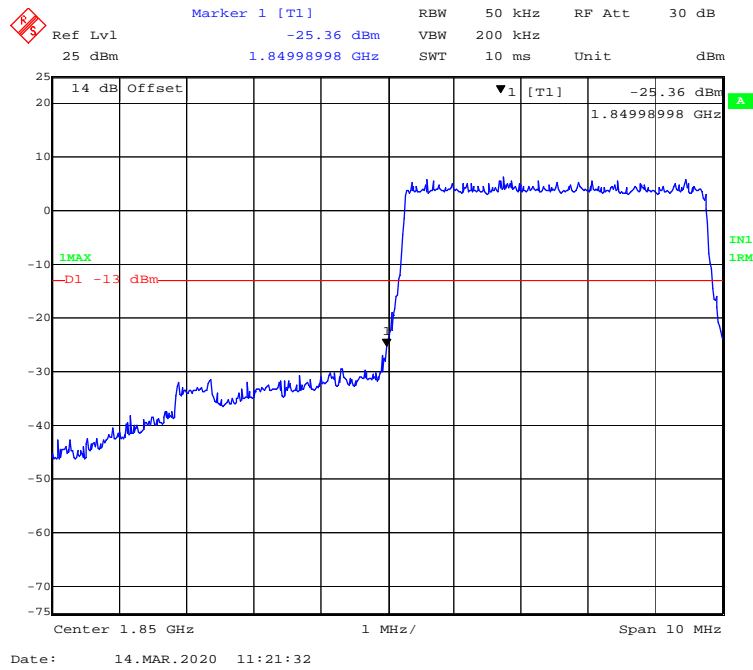
QPSK (3.0 MHz, FULL RB) - Left Band Edge



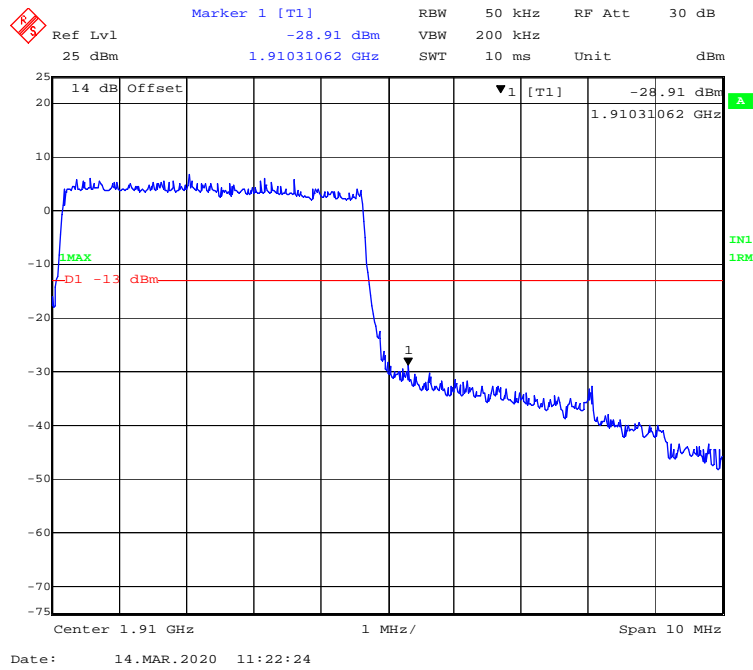
QPSK (3.0 MHz, FULL RB) - Right Band Edge



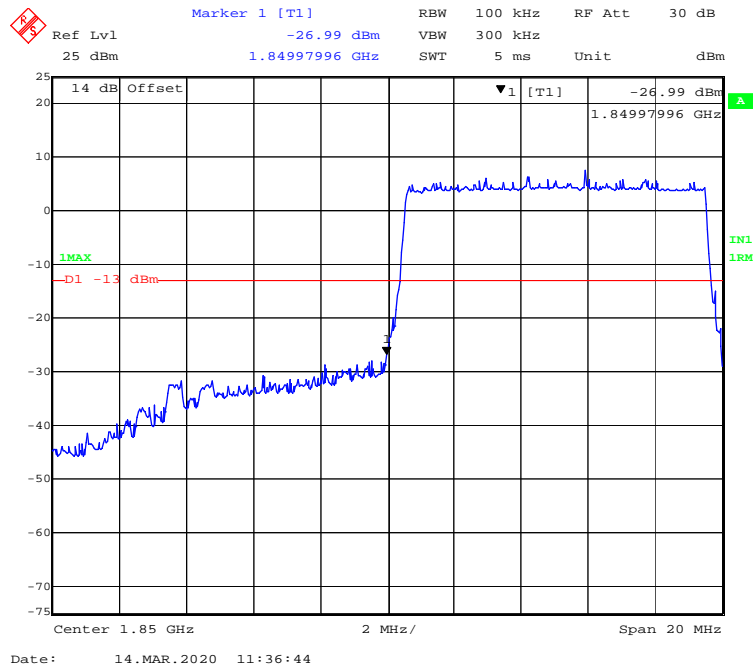
QPSK (5.0 MHz, FULL RB) - Left Band Edge



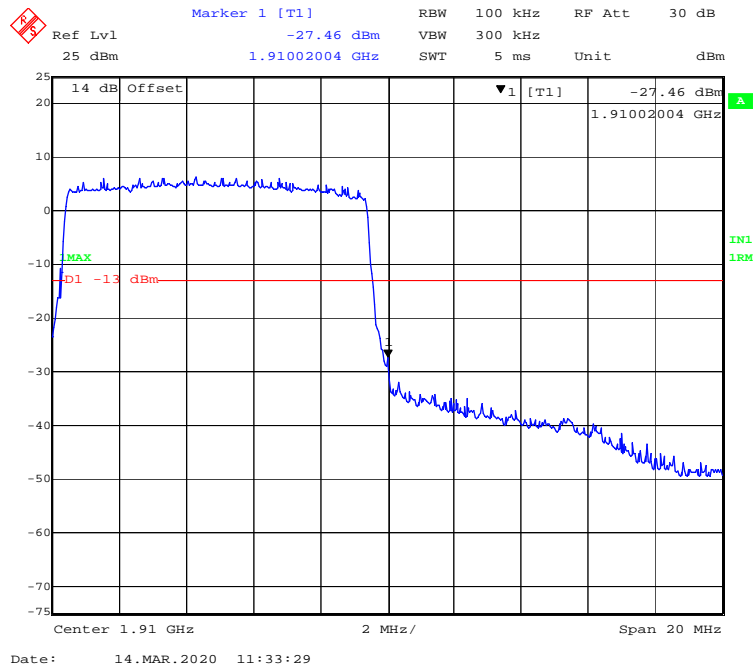
QPSK (5.0 MHz, FULL RB) - Right Band Edge



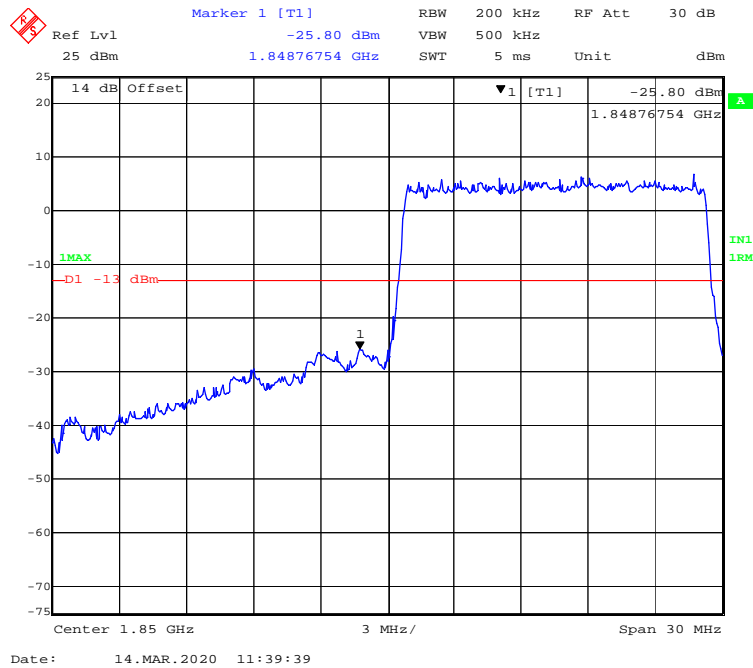
QPSK (10.0 MHz, FULL RB) - Left Band Edge



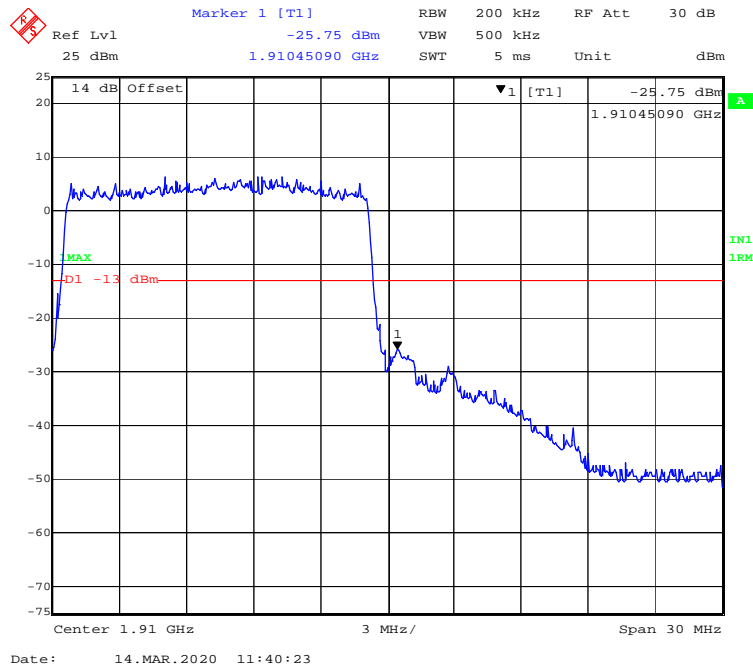
QPSK (10.0 MHz, FULL RB) - Right Band Edge



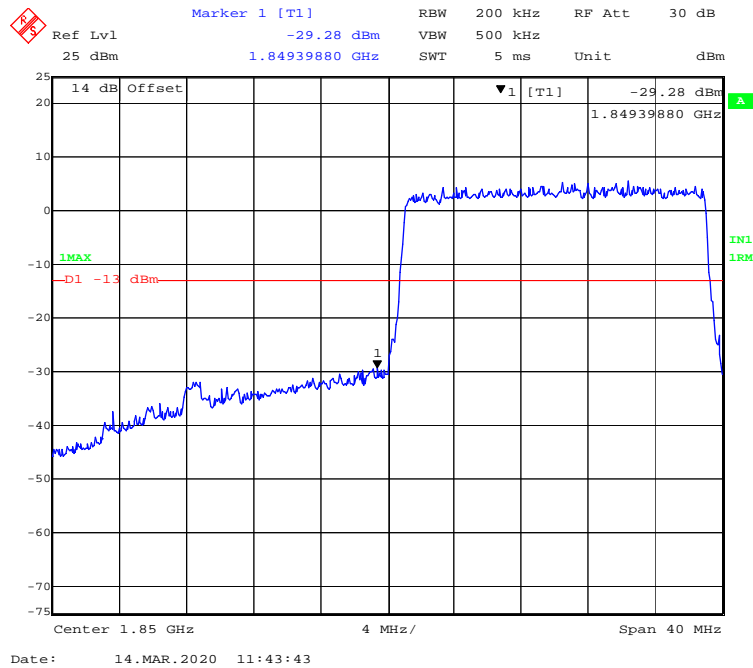
QPSK (15.0 MHz, FULL RB) - Left Band Edge



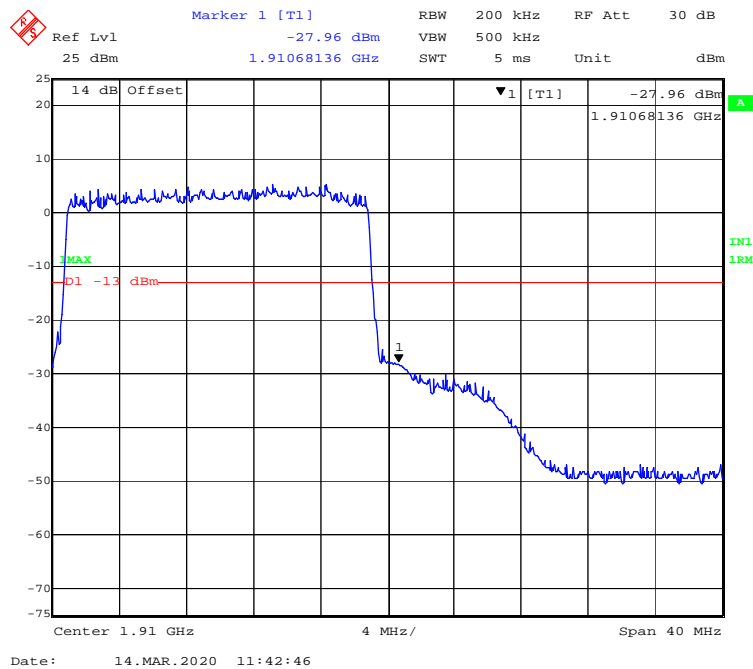
QPSK (15.0 MHz, FULL RB) - Right Band Edge



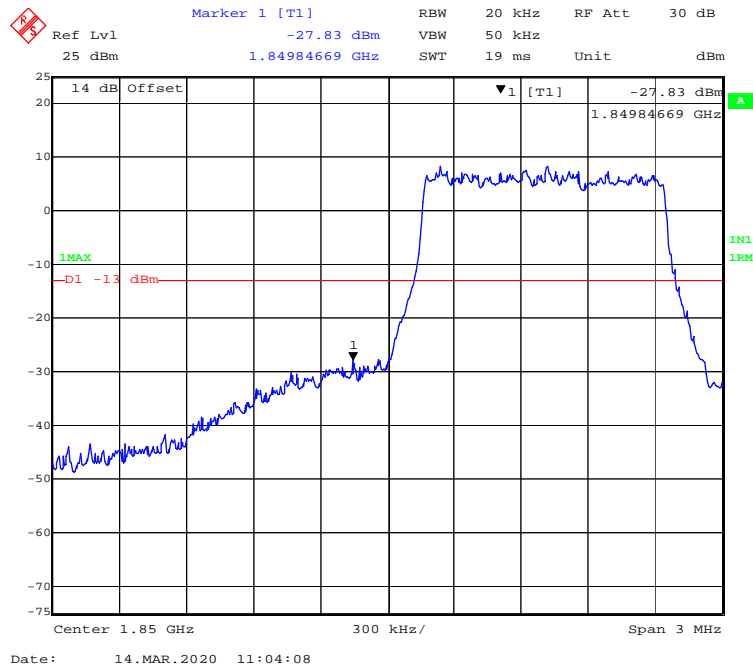
QPSK (20.0 MHz, FULL RB) - Left Band Edge



QPSK (20.0 MHz, FULL RB) - Right Band Edge



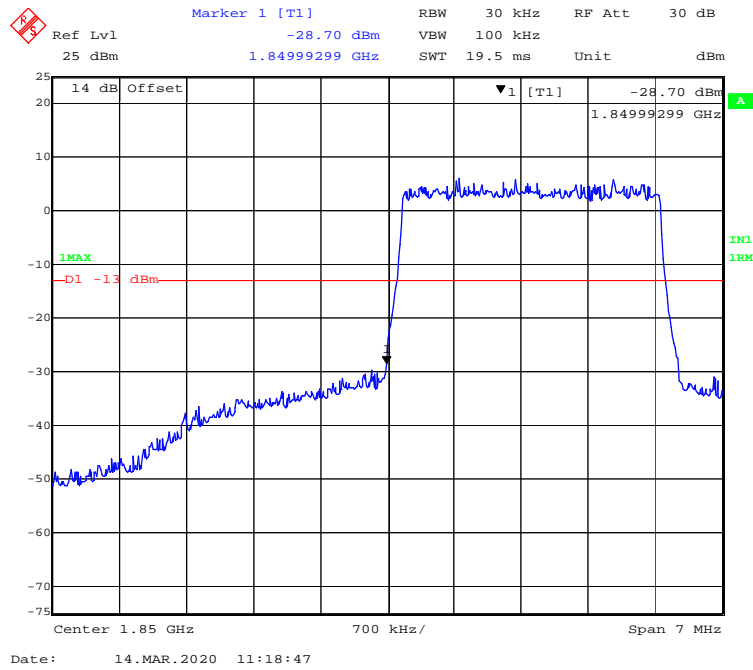
16-QAM (1.4 MHz, FULL RB) - Left Band Edge



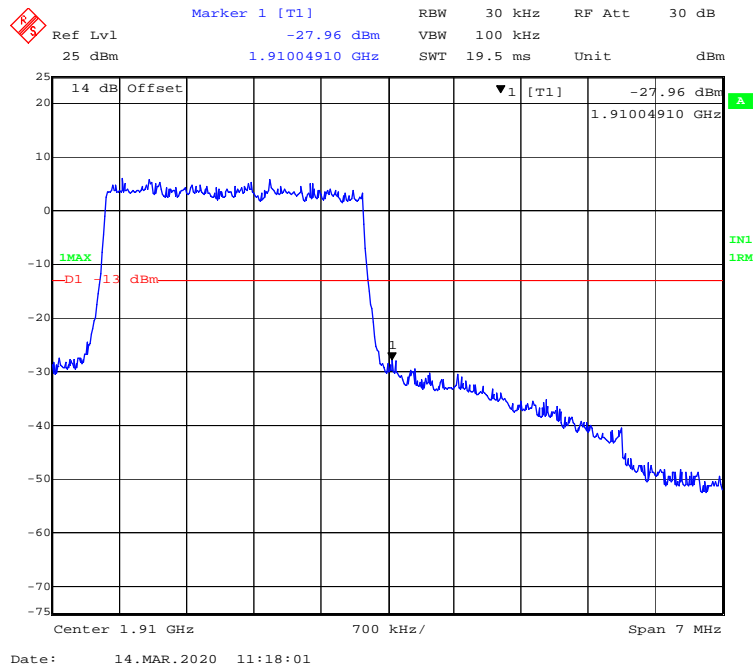
16-QAM (1.4 MHz, FULL RB) - Right Band Edge



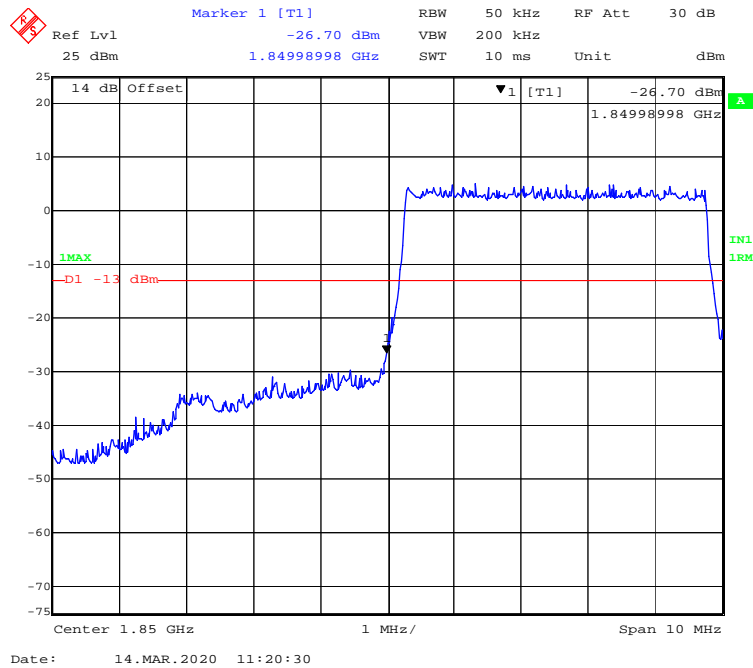
16-QAM (3.0 MHz, FULL RB) - Left Band Edge



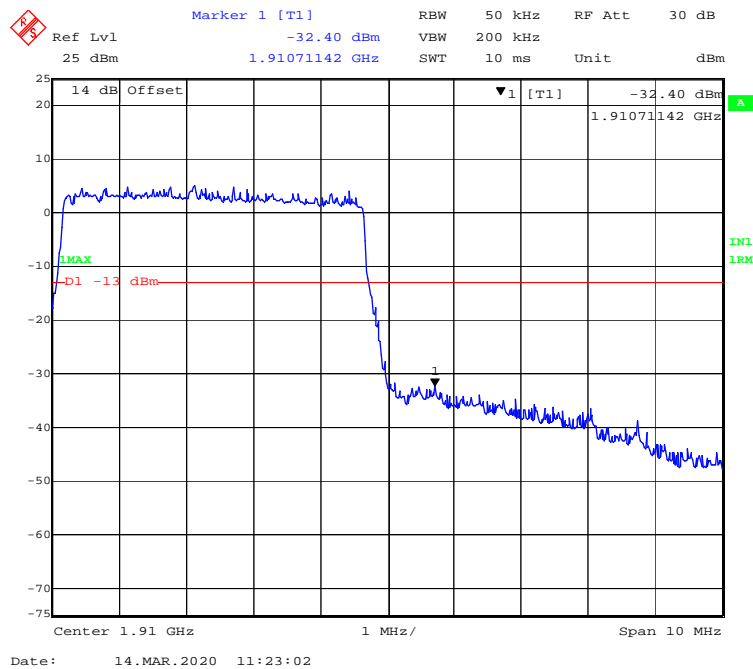
16-QAM (3.0 MHz, FULL RB) - Right Band Edge



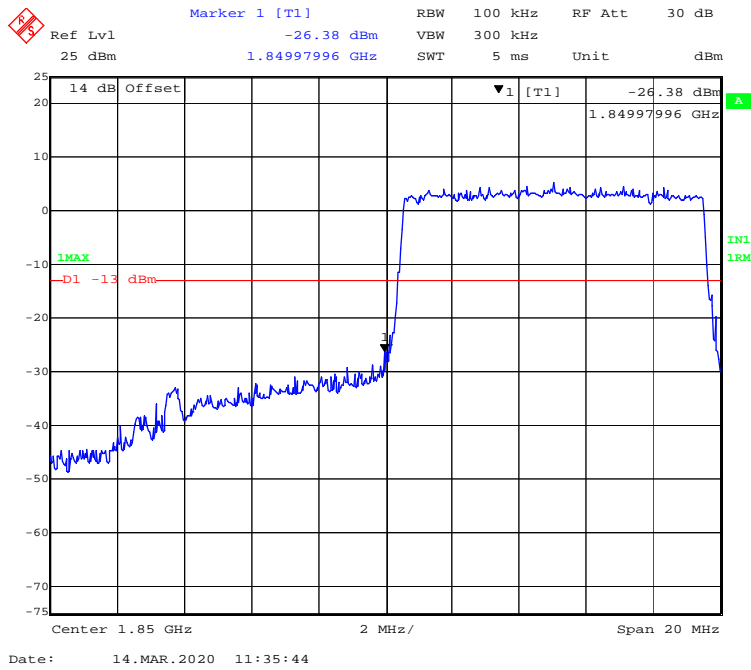
16-QAM (5.0 MHz, FULL RB) - Left Band Edge



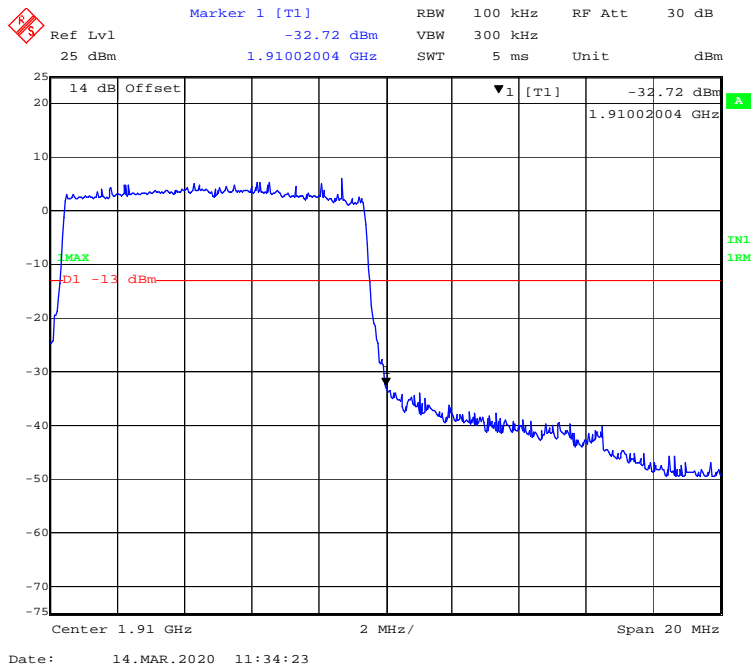
16-QAM (5.0 MHz, FULL RB) - Right Band Edge



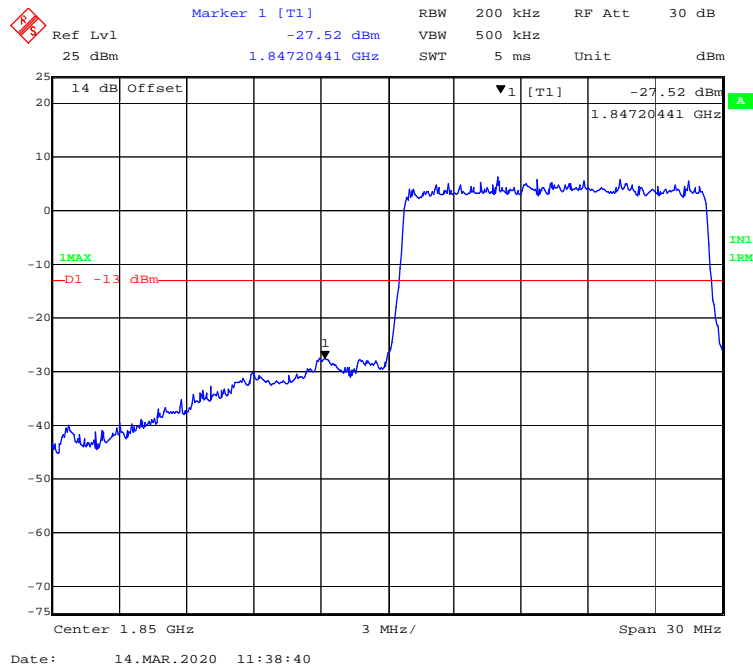
16-QAM (10.0 MHz, FULL RB) - Left Band Edge



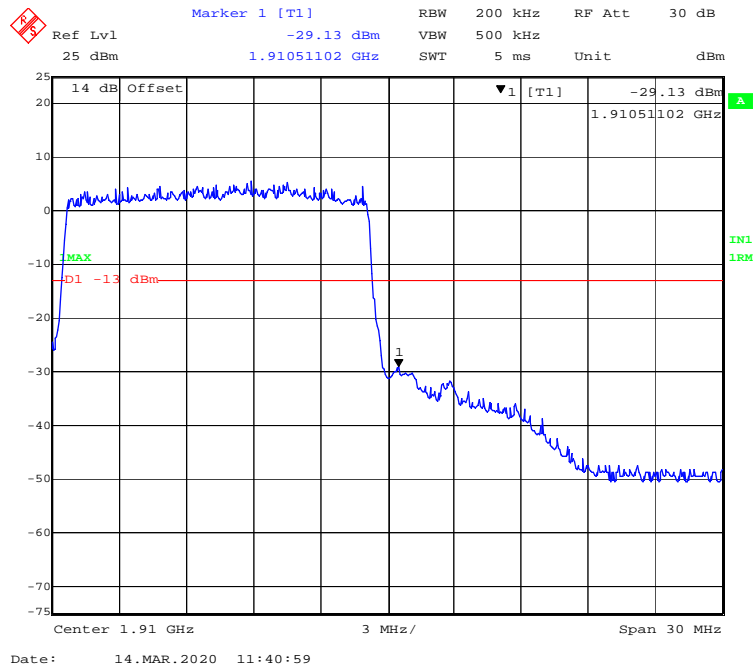
16-QAM (10.0 MHz, FULL RB) - Right Band Edge



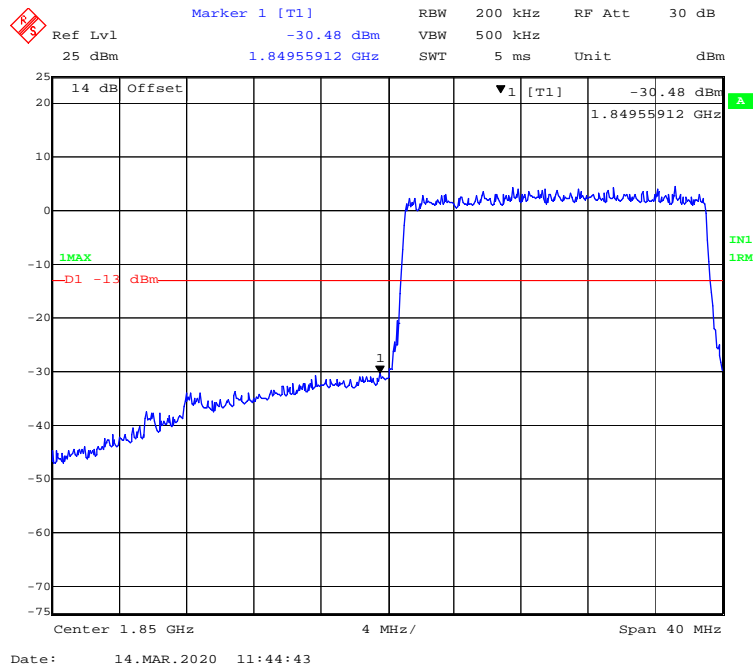
16-QAM (15.0 MHz, FULL RB) - Left Band Edge



16-QAM (15.0 MHz, FULL RB) - Right Band Edge



16-QAM (20.0 MHz, FULL RB) - Left Band Edge

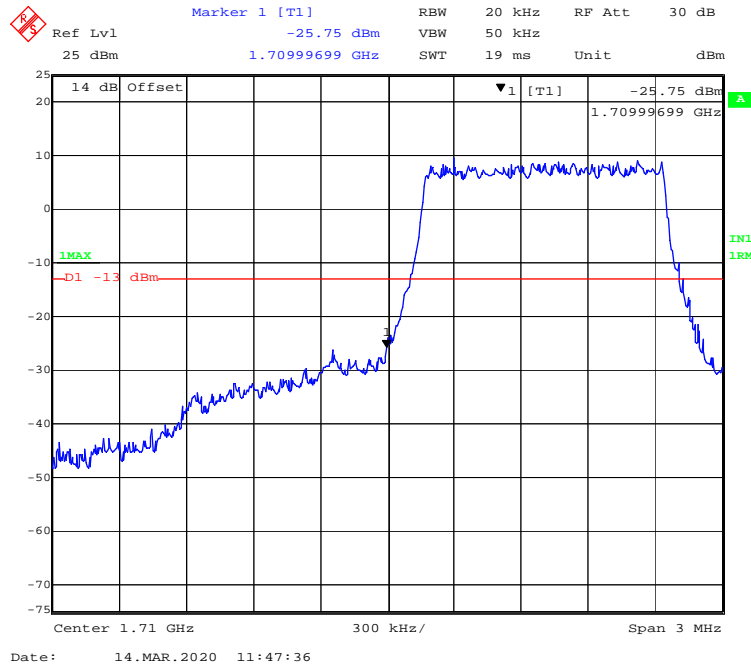


16-QAM (20.0 MHz, FULL RB) - Right Band Edge

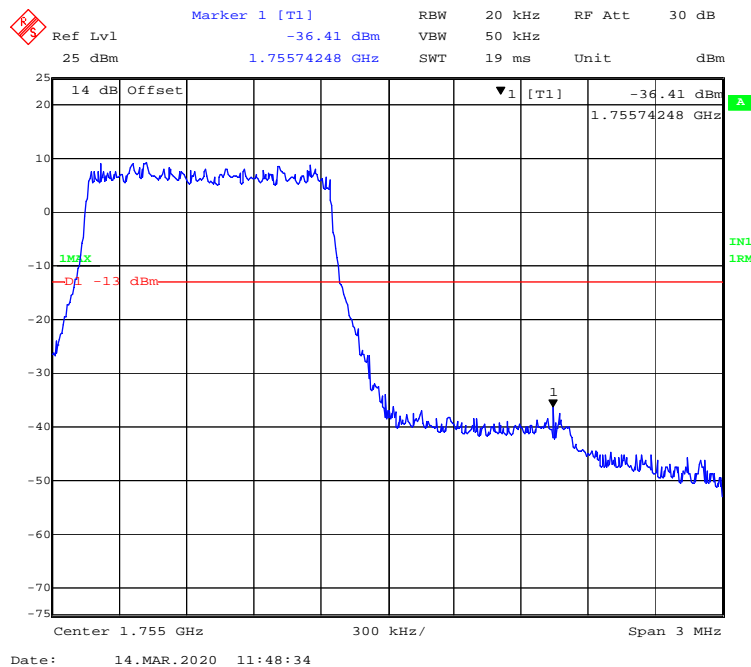


LTE Band 4:

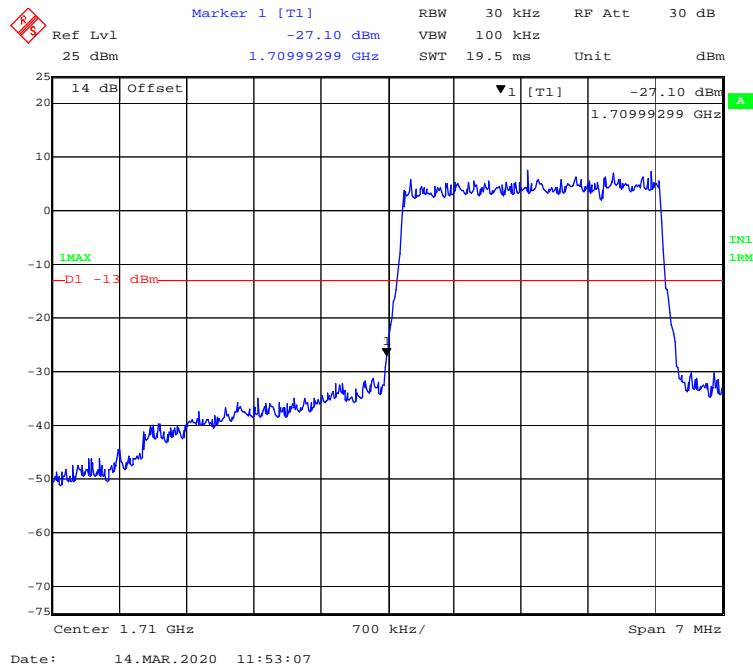
QPSK (1.4 MHz, FULL RB) - Left Band Edge



QPSK (1.4 MHz, FULL RB) - Right Band Edge



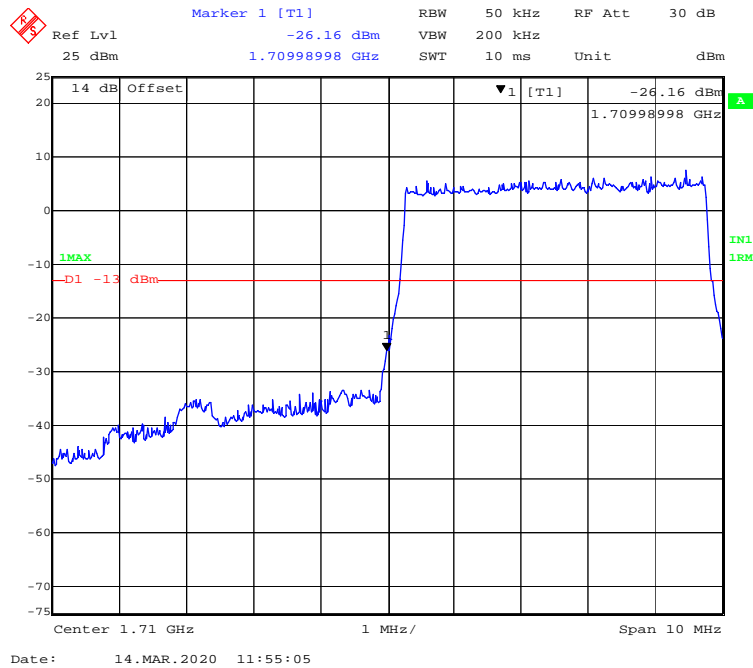
QPSK (3.0 MHz, FULL RB) - Left Band Edge



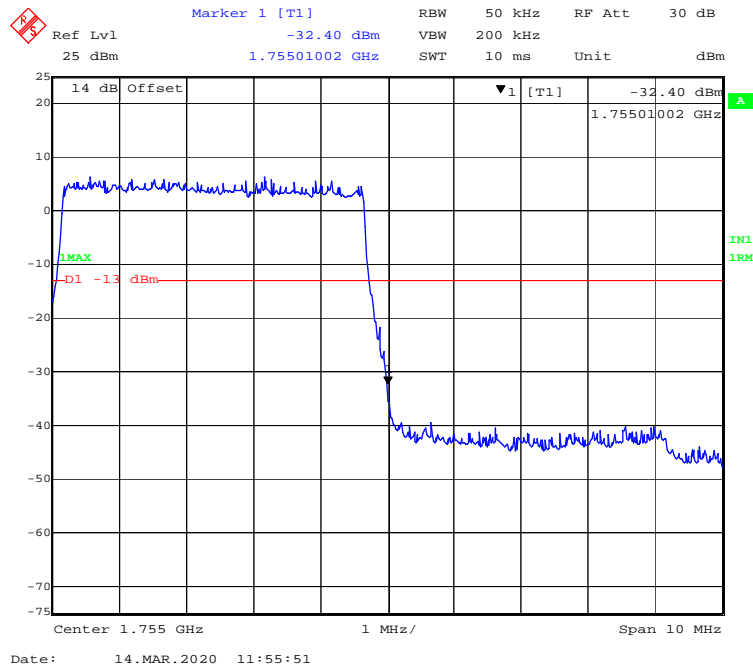
QPSK (3.0 MHz, FULL RB) - Right Band Edge



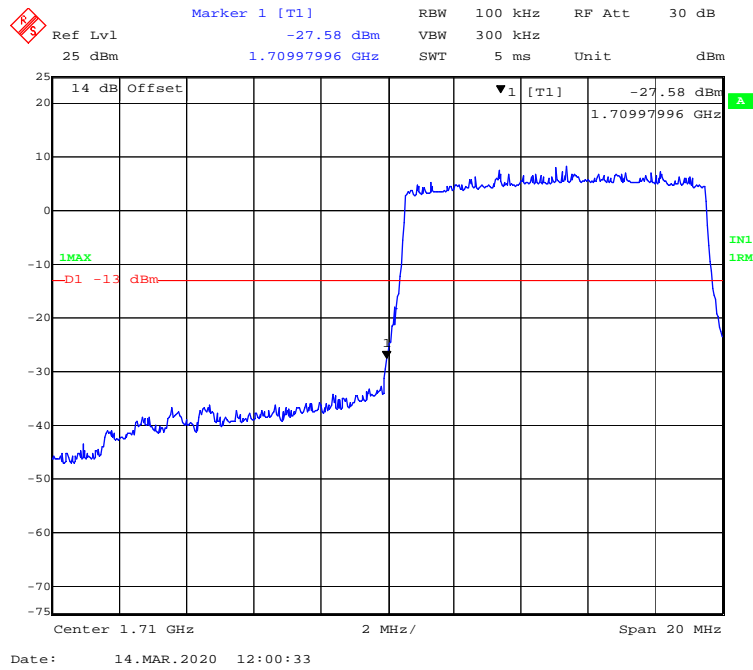
QPSK (5.0 MHz, FULL RB) - Left Band Edge



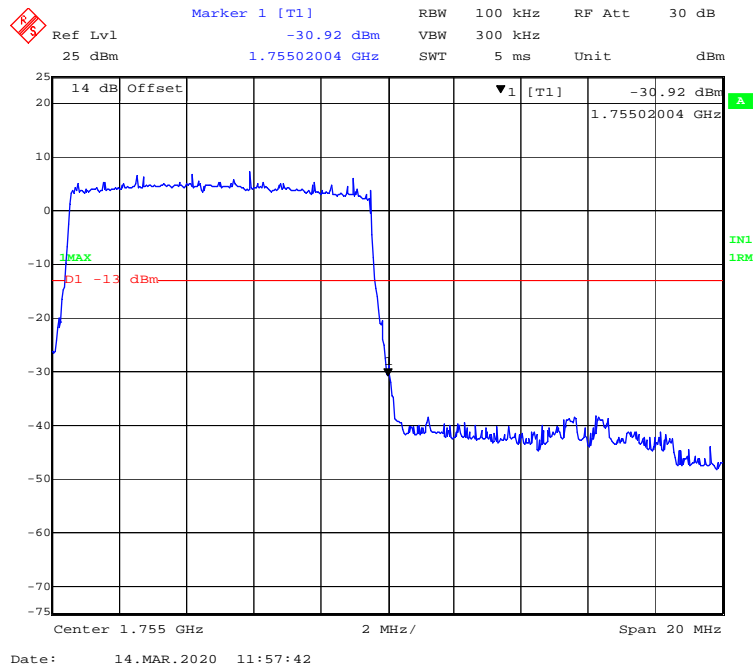
QPSK (5.0 MHz, FULL RB) - Right Band Edge



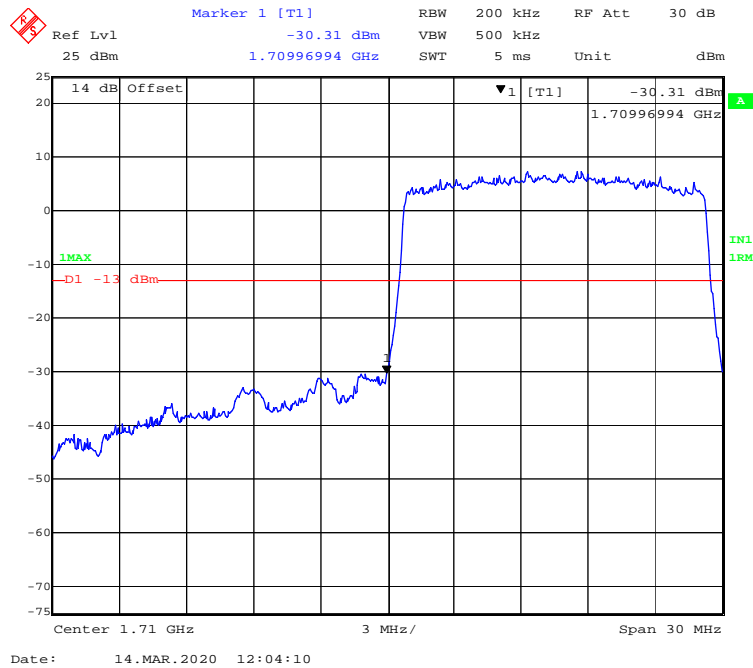
QPSK (10.0 MHz, FULL RB) - Left Band Edge



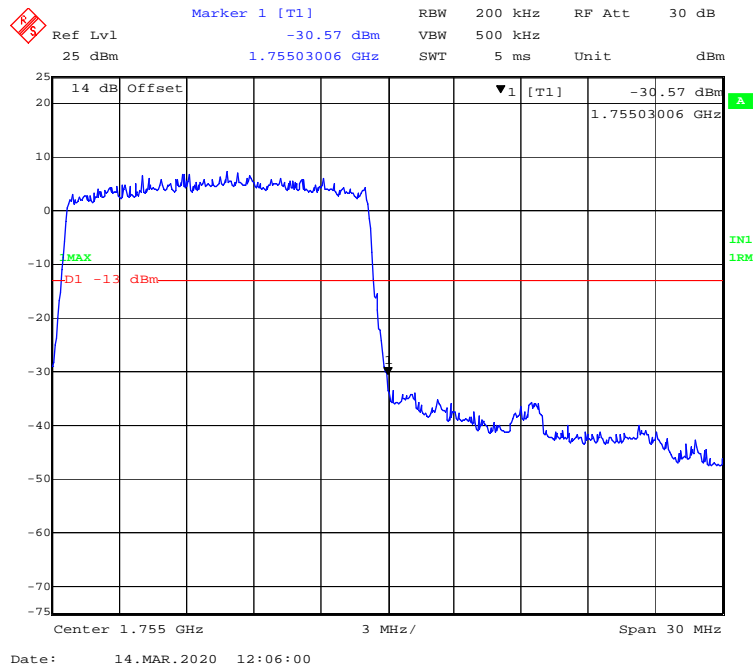
QPSK (10.0 MHz, FULL RB) - Right Band Edge



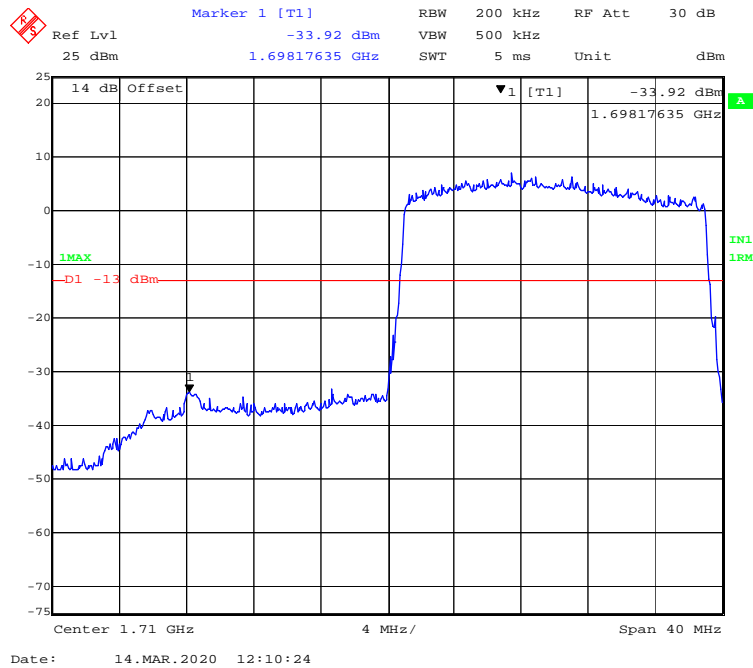
QPSK (15.0 MHz, FULL RB) - Left Band Edge



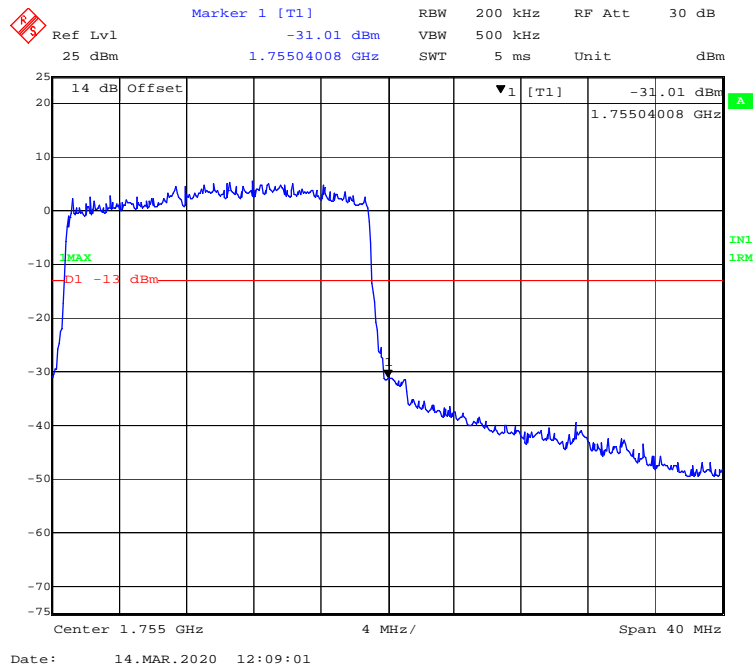
QPSK (15.0 MHz, FULL RB) - Right Band Edge



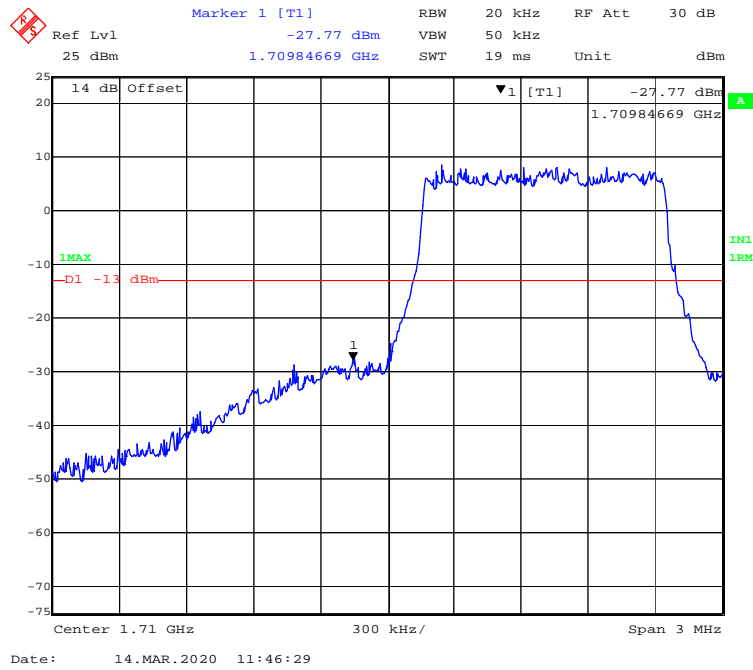
QPSK (20.0 MHz, FULL RB) - Left Band Edge



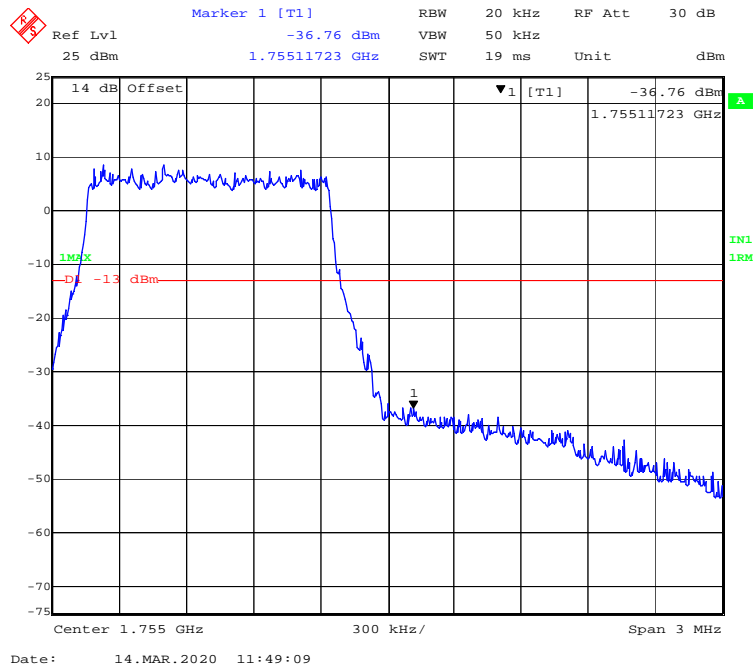
QPSK (20.0 MHz, FULL RB) - Right Band Edge



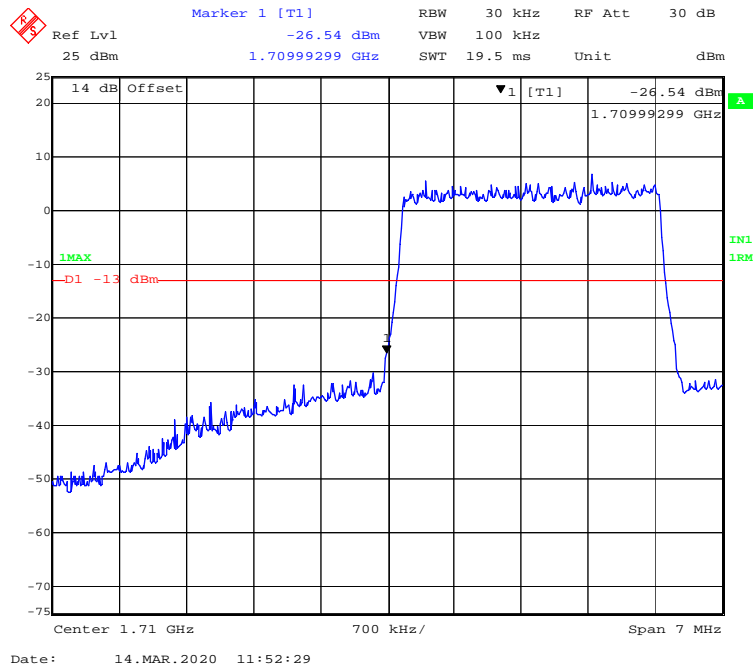
16-QAM (1.4 MHz, FULL RB) - Left Band Edge



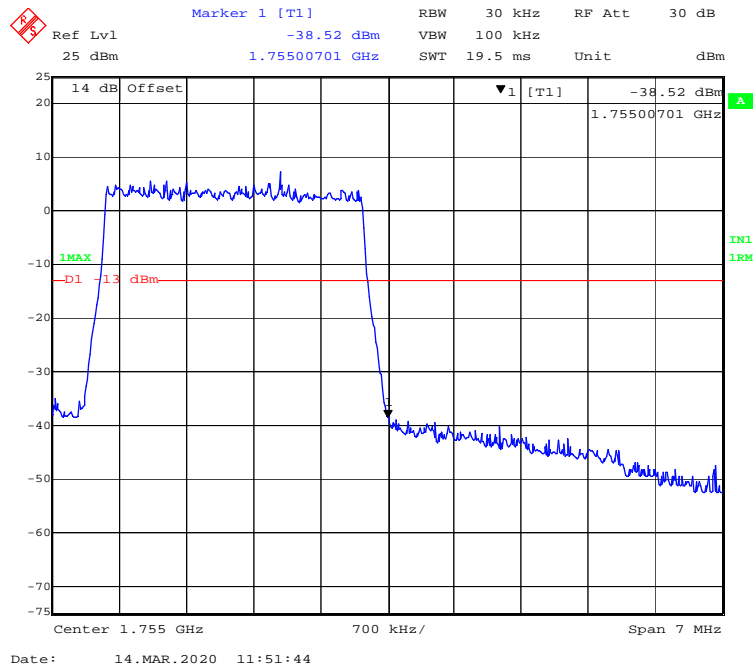
16-QAM (1.4 MHz, FULL RB) - Right Band Edge



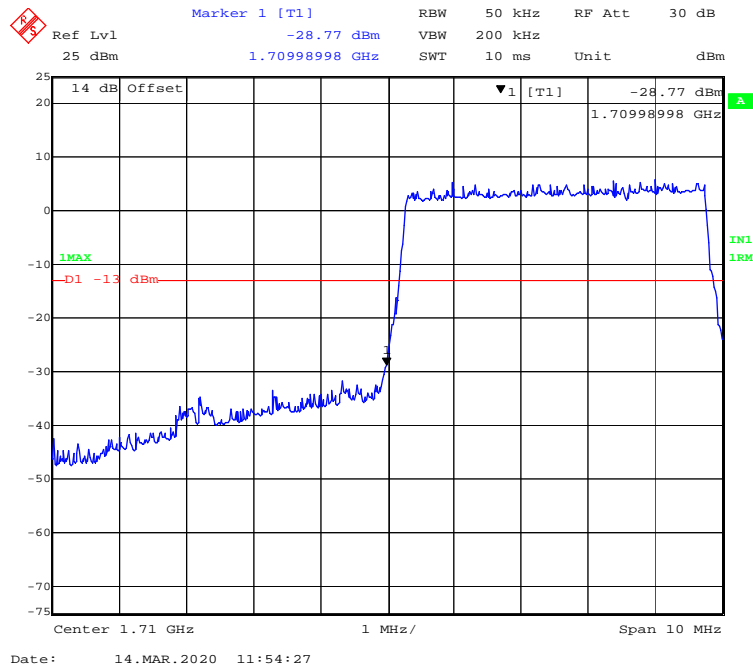
16-QAM (3.0 MHz, FULL RB) - Left Band Edge



16-QAM (3.0 MHz, FULL RB) - Right Band Edge



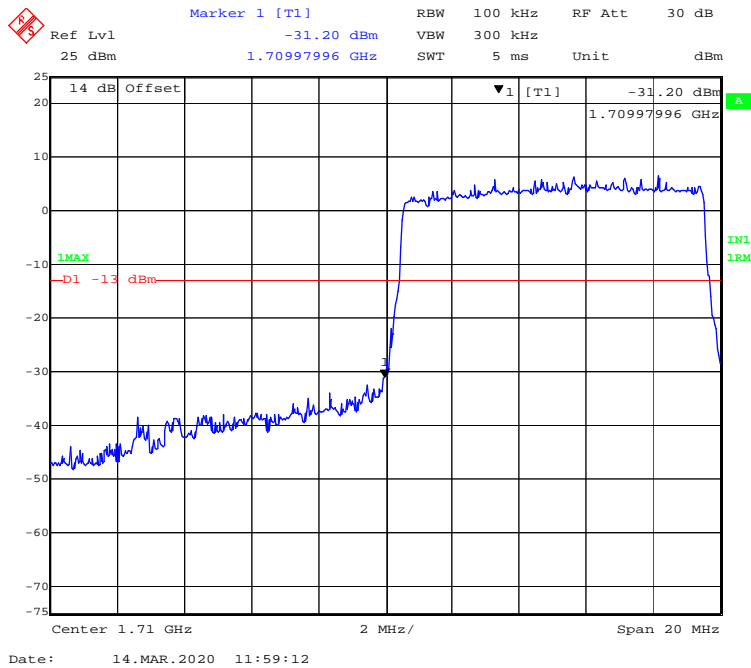
16-QAM (5.0 MHz, FULL RB) - Left Band Edge



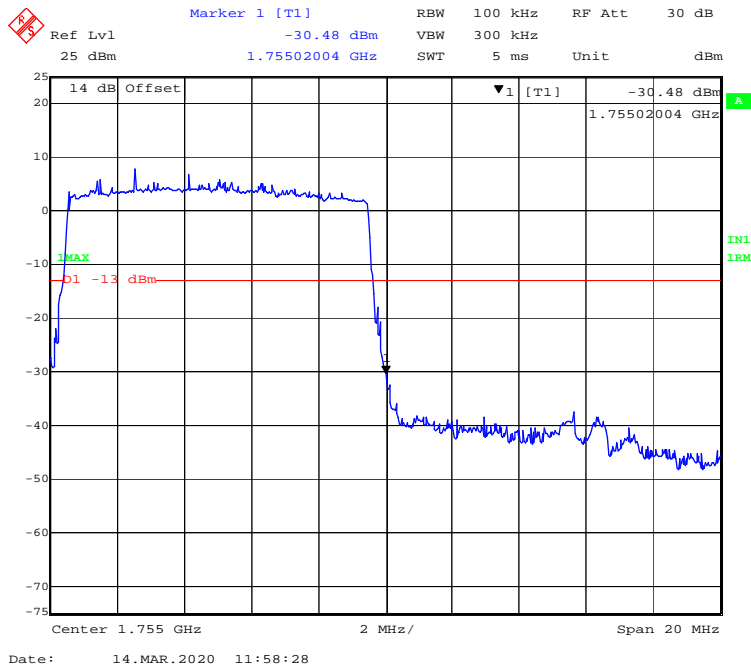
16-QAM (5.0 MHz, FULL RB) - Right Band Edge



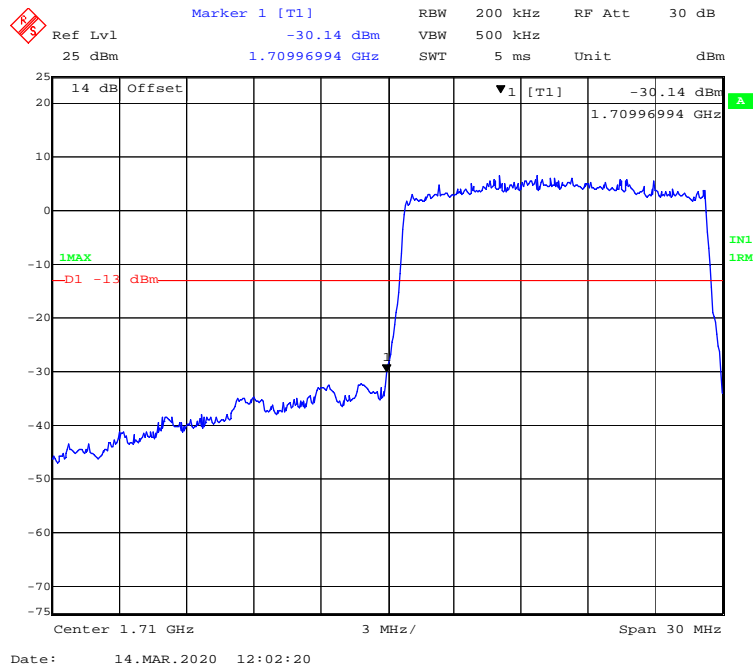
16-QAM (10.0 MHz, FULL RB) - Left Band Edge



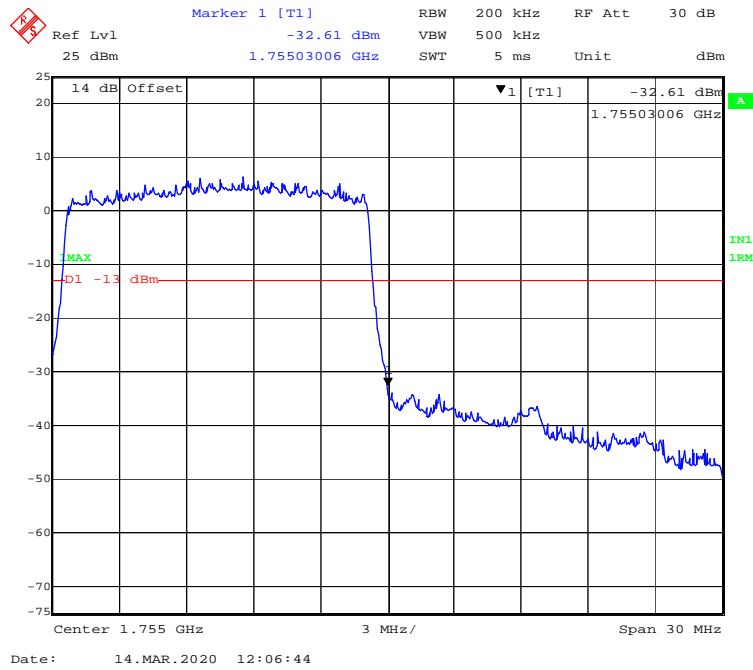
16-QAM (10.0 MHz, FULL RB) - Right Band Edge



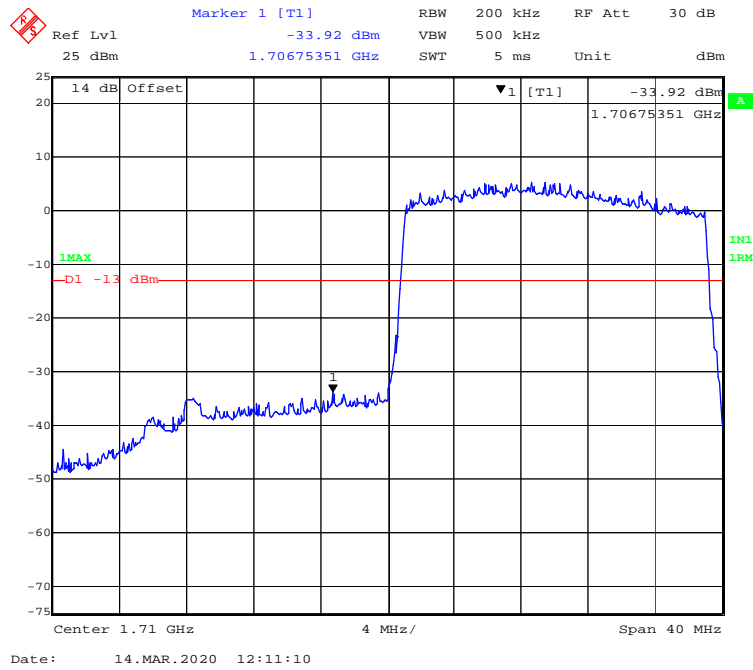
16-QAM (15.0 MHz, FULL RB) - Left Band Edge



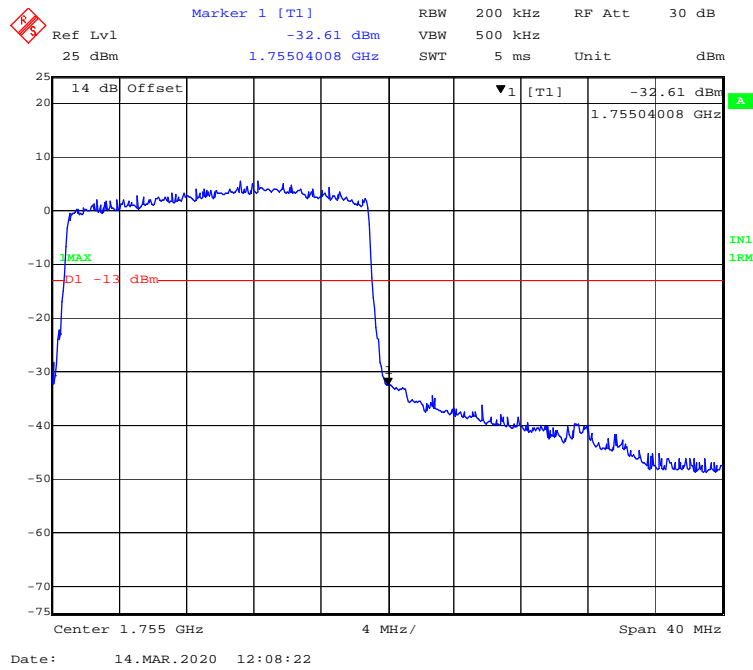
16-QAM (15.0 MHz, FULL RB) - Right Band Edge



16-QAM (20.0 MHz, FULL RB) - Left Band Edge

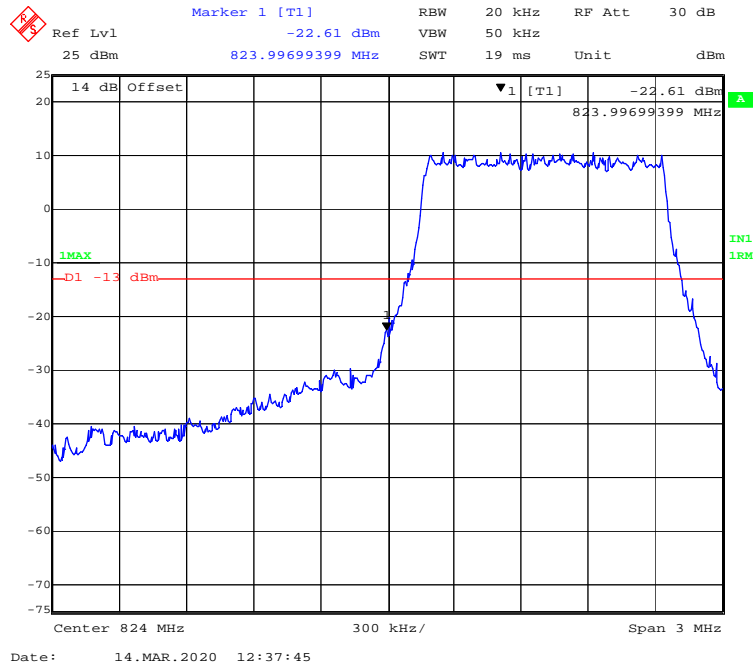


16-QAM (20.0 MHz, FULL RB) - Right Band Edge

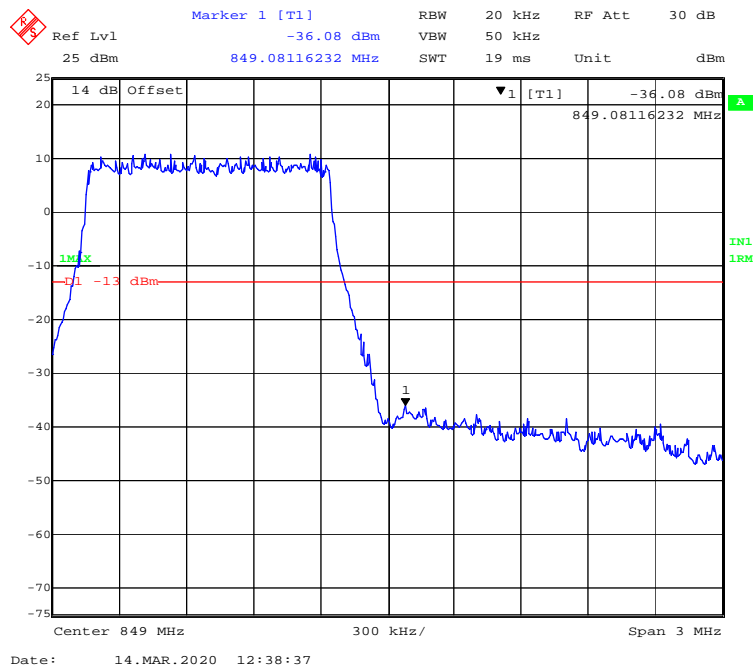


LTE Band 5:

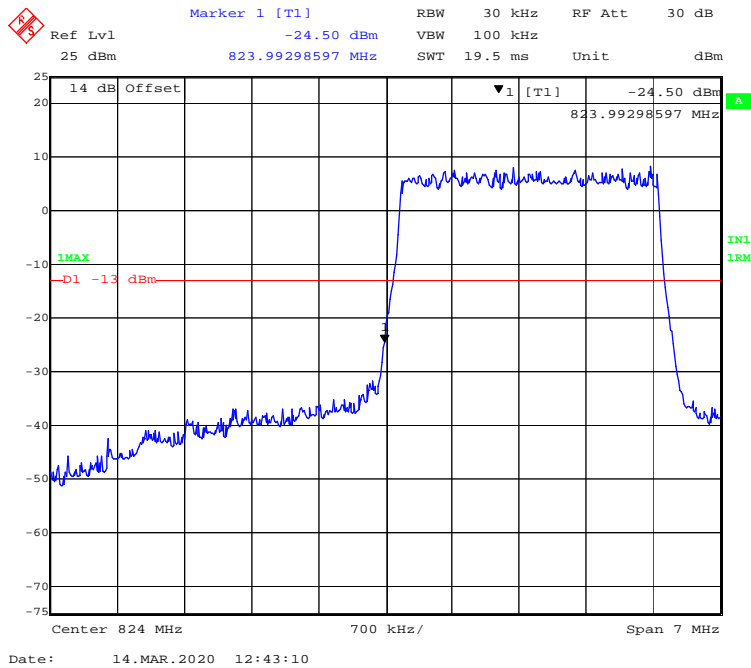
QPSK (1.4 MHz, FULL RB) - Left Band Edge



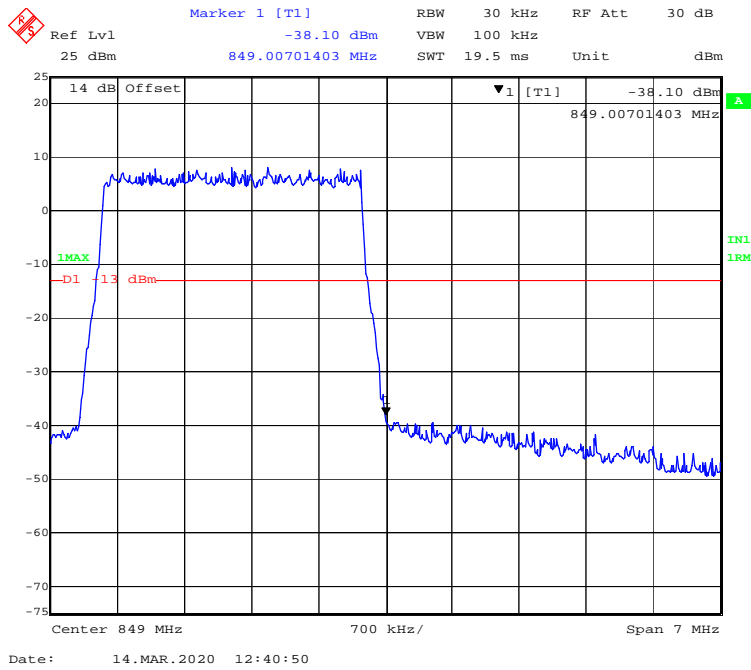
QPSK (1.4 MHz, FULL RB) - Right Band Edge



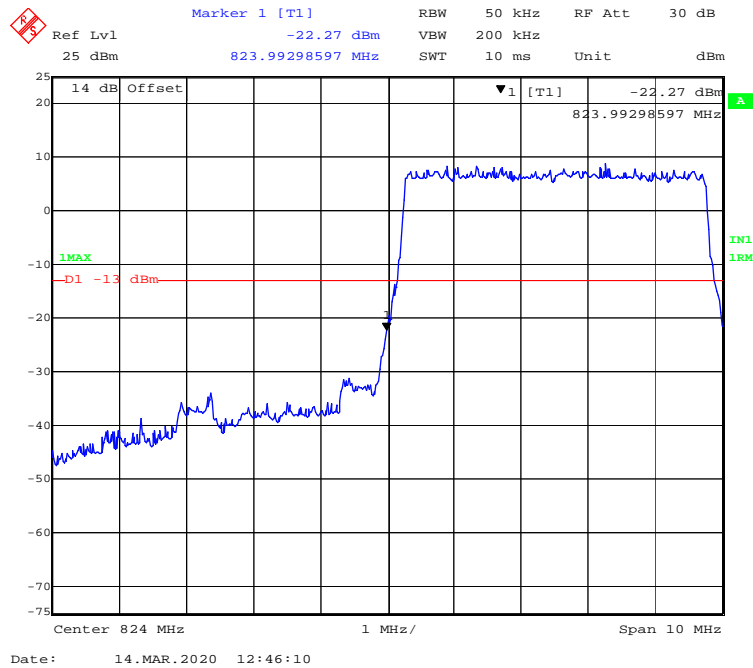
QPSK (3.0 MHz, FULL RB) - Left Band Edge



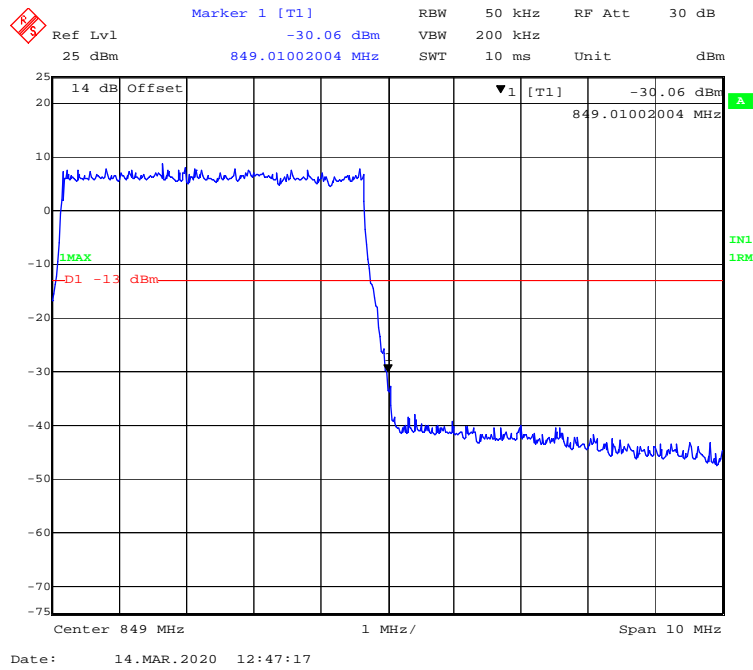
QPSK (3.0 MHz, FULL RB) - Right Band Edge



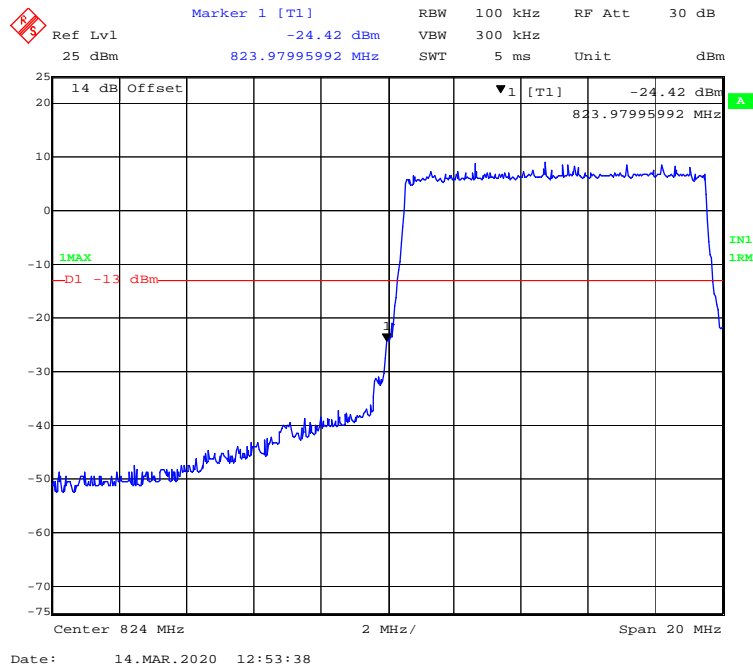
QPSK (5.0 MHz, FULL RB) - Left Band Edge



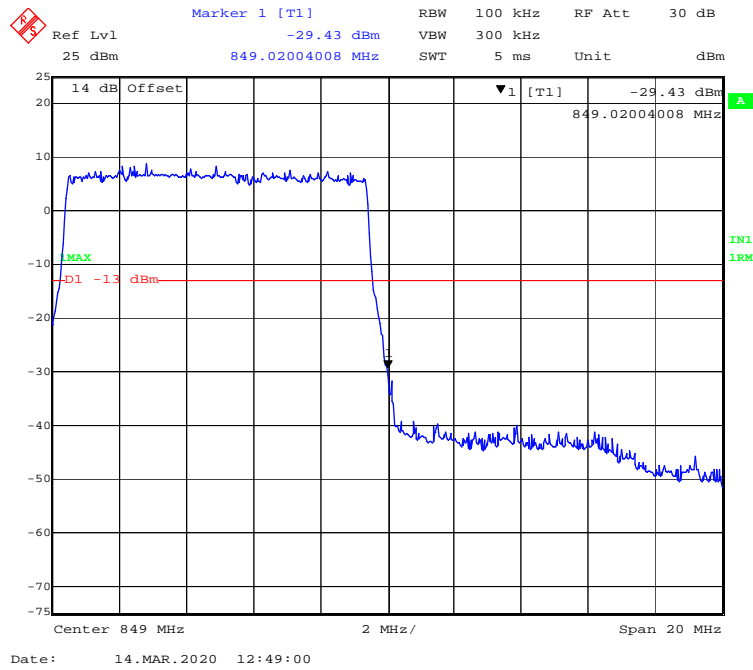
QPSK (5.0 MHz, FULL RB) - Right Band Edge



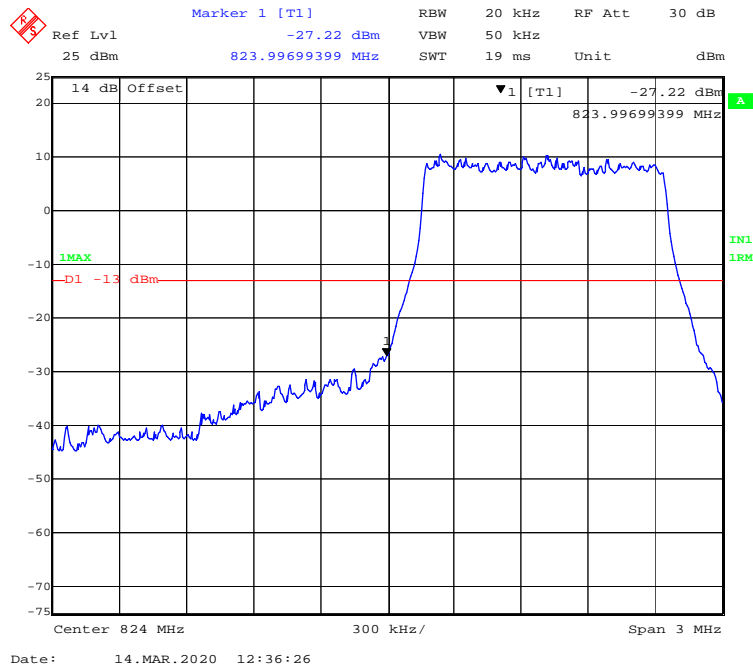
QPSK (10.0 MHz, FULL RB) - Left Band Edge



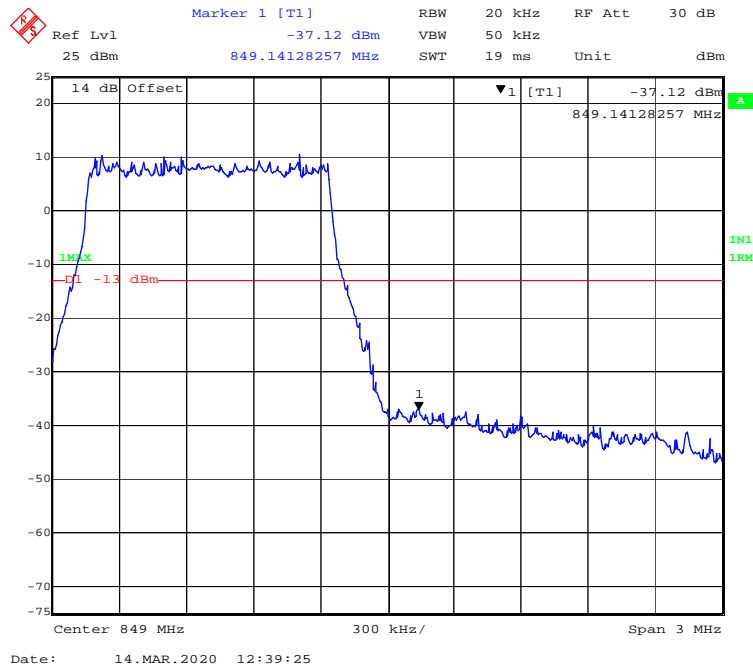
QPSK (10.0 MHz, FULL RB) - Right Band Edge



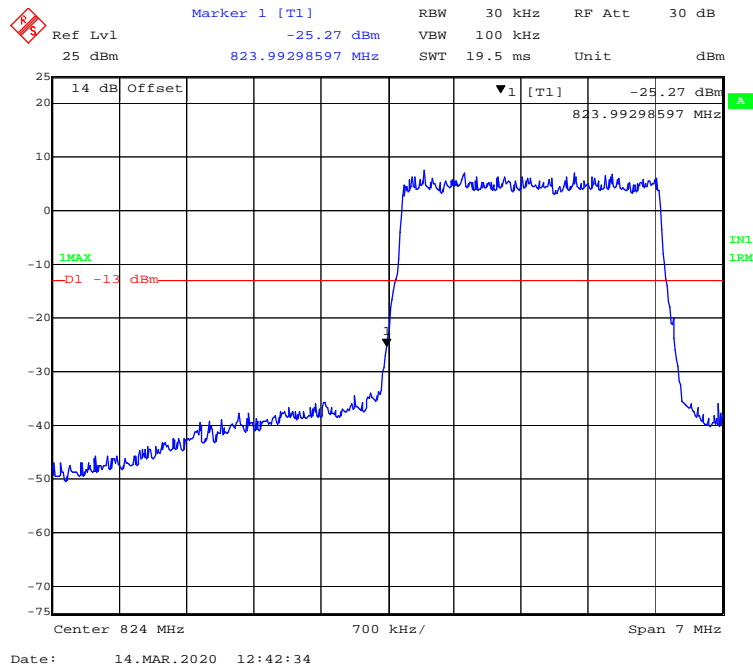
16-QAM (1.4 MHz, FULL RB) - Left Band Edge



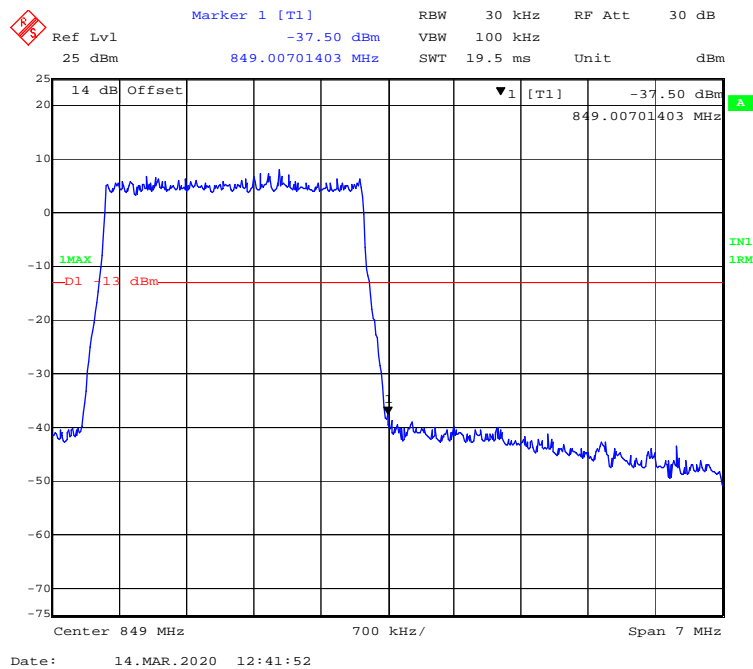
16-QAM (1.4 MHz, FULL RB) - Right Band Edge



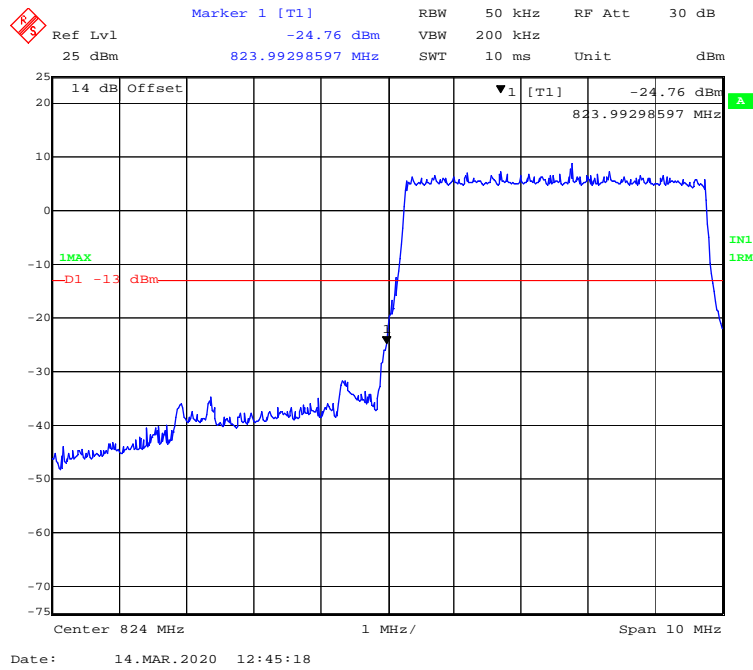
16-QAM (3.0 MHz, FULL RB) - Left Band Edge



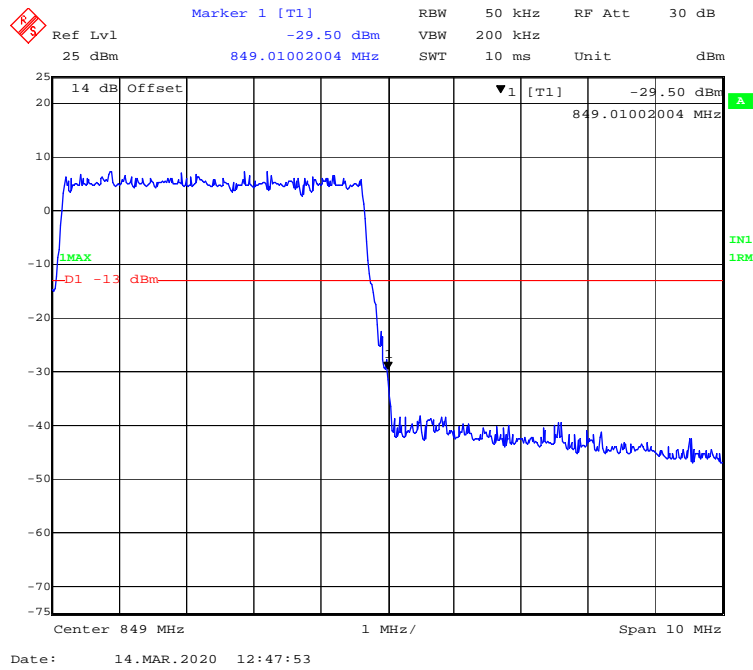
16-QAM (3.0 MHz, FULL RB) - Right Band Edge



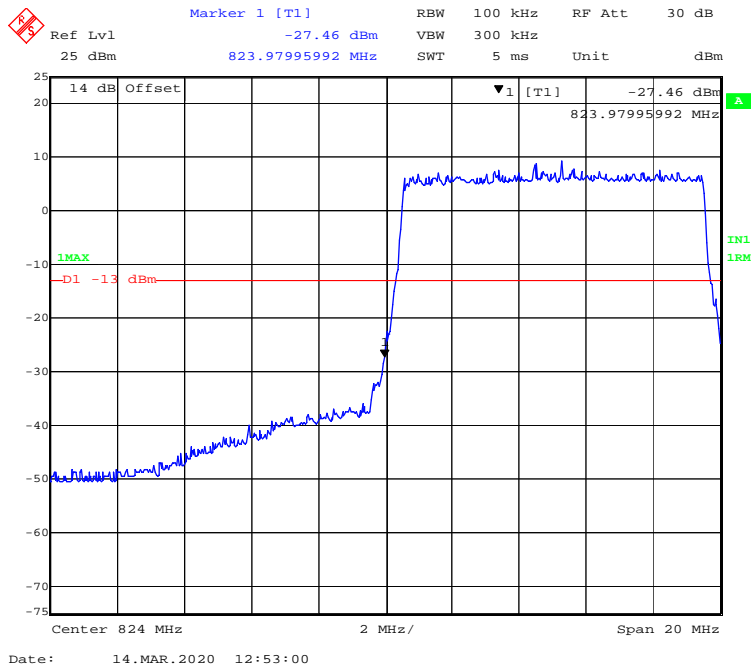
16-QAM (5.0 MHz, FULL RB) - Left Band Edge



16-QAM (5.0 MHz, FULL RB) - Right Band Edge



16-QAM (10.0 MHz, FULL RB) - Left Band Edge



16-QAM (10.0 MHz, FULL RB) - Right Band Edge



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

Applicable Standards

FCC § 2.1055, §22.355, §24.235 and §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

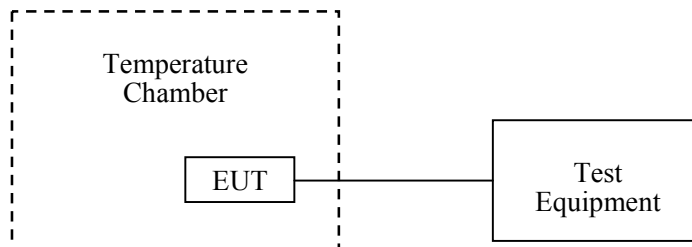
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

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:	23.2 °C
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

The testing was performed by CK Huang on 2020-03-19.

EUT operation mode: Transmitting

Test Result: Compliant.

GSM 850 Band:

GPRS Mode, Middle Channel, f _o =836.6 MHz				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	12	11	0.01315	2.5
-20		13	0.01554	2.5
-10		12	0.01434	2.5
0		7	0.00837	2.5
10		9	0.01076	2.5
20		11	0.01315	2.5
30		9	0.01076	2.5
40		8	0.00956	2.5
50		10	0.01195	2.5
20		V min.= 9	7	0.00837
20	V max.=36	3	0.00359	2.5

EGPRS Mode, Middle Channel, $f_0 = 836.6$ MHz				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	12	13	0.01554	2.5
-20		7	0.00837	2.5
-10		2	0.00239	2.5
0		10	0.01195	2.5
10		11	0.01315	2.5
20		12	0.01434	2.5
30		11	0.01315	2.5
40		5	0.00598	2.5
50		6	0.00717	2.5
20		V min.= 9	4	0.00478
20	V max.=36	5	0.00598	2.5

WCDMA Band V:

Middle Channel, $f_0 = 836.6$ MHz				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	12	14	0.01673	2.5
-20		5	0.00598	2.5
-10		13	0.01554	2.5
0		11	0.01315	2.5
10		9	0.01076	2.5
20		8	0.00956	2.5
30		10	0.01195	2.5
40		6	0.00717	2.5
50		9	0.01076	2.5
20		V min.= 9	13	0.01554
20	V max.=36	9	0.01076	2.5

PCS 1900 Band:

GPRS Mode, Middle Channel, f₀ =1880.0 MHz				
Temperature (°C)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Result
-30	12	-10	-0.00532	pass
-20		-9	-0.00479	pass
-10		-5	-0.00266	pass
0		-4	-0.00213	pass
10		-10	-0.00532	pass
20		-4	-0.00213	pass
30		-4	-0.00213	pass
40		-11	-0.00585	pass
50		-10	-0.00532	pass
20	V min.= 9	-11	-0.00585	pass
20	V max.=36	-6	-0.00319	pass

EGPRS Mode, Middle Channel, f₀ =1880.0 MHz				
Temperature (°C)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Result
-30	12	-9	-0.00479	pass
-20		-7	-0.00372	pass
-10		-5	-0.00266	pass
0		-4	-0.00213	pass
10		-1	-0.00053	pass
20		1	0.00053	pass
30		-6	-0.00319	pass
40		-2	-0.00106	pass
50		-10	-0.00532	pass
20	V min.= 9	-8	-0.00426	pass
20	V max.=36	-7	-0.00372	pass

WCDMA Band II:

WCDMA Mode, Middle Channel, f_o=1880.0 MHz				
Temperature (°C)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Result
-30	12	-2	-0.00106	pass
-20		-8	-0.00426	pass
-10		-4	-0.00213	pass
0		-3	-0.00160	pass
10		2	0.00106	pass
20		-7	-0.00372	pass
30		3	0.00160	pass
40		-11	-0.00585	pass
50		-8	-0.00426	pass
20		V min.= 9	-7	-0.00372
20	V max.=36	-10	-0.00532	pass

LTE Band 2:

Middle Channel, $f_o=1880.0$ MHz (QPSK)				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Result
-30	12	12	0.00638	pass
-20		11	0.00585	pass
-10		10	0.00532	pass
0		9	0.00479	pass
10		9	0.00479	pass
20		8	0.00426	pass
30		7	0.00372	pass
40		9	0.00479	pass
50		11	0.00585	pass
20	V min.= 9	9	0.00479	pass
20	V max.=36	11	0.00585	pass

Middle Channel, $f_o=1880.0$ MHz (16-QAM)				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Result
-30	12	12	0.00638	pass
-20		11	0.00585	pass
-10		10	0.00532	pass
0		10	0.00532	pass
10		9	0.00479	pass
20		8	0.00426	pass
30		7	0.00372	pass
40		9	0.00479	pass
50		11	0.00585	pass
20	V min.= 9	7	0.00372	pass
20	V max.=36	8	0.00426	pass

LTE Band 4:

Low Channel & High Channel (QPSK)					
Temperature	Power Supplied	F _L	F _H	F _L Limit	F _H Limit
(°C)	(V _{DC})	(MHz)	(MHz)	(MHz)	(MHz)
-30	12	1710.04484	1754.94639	1710	1755
-20		1710.04701	1754.94317	1710	1755
-10		1710.04564	1754.94121	1710	1755
0		1710.04045	1754.94123	1710	1755
10		1710.04103	1754.94450	1710	1755
20		1710.04023	1754.94644	1710	1755
30		1710.04858	1754.94621	1710	1755
40		1710.04322	1754.94133	1710	1755
50		1710.04268	1754.94988	1710	1755
20		V min.= 9	1710.04936	1754.94367	1710
20	V max.=36	1710.04635	1754.94409	1710	1755

Low Channel & High Channel (16-QAM)					
Temperature	Power Supplied	F _L	F _H	F _L Limit	F _H Limit
(°C)	(V _{DC})	(MHz)	(MHz)	(MHz)	(MHz)
-30	12	1710.04370	1754.94598	1710	1755
-20		1710.04122	1754.94527	1710	1755
-10		1710.04844	1754.94641	1710	1755
0		1710.04254	1754.94393	1710	1755
10		1710.04422	1754.94869	1710	1755
20		1710.04822	1754.94645	1710	1755
30		1710.04977	1754.94306	1710	1755
40		1710.04569	1754.94828	1710	1755
50		1710.04707	1754.94709	1710	1755
20		V min.= 9	1710.04808	1754.94088	1710
20	V max.=36	1710.04749	1754.94765	1710	1755

LTE Band 5:

Middle Channel, f₀ =836.6 MHz (QPSK)				
Temperature (°C)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	12	12	0.01435	2.5
-20		11	0.01315	2.5
-10		10	0.01195	2.5
0		10	0.01195	2.5
10		9	0.01076	2.5
20		8	0.00956	2.5
30		8	0.00956	2.5
40		9	0.01076	2.5
50		11	0.01315	2.5
20		V min.= 9	10	0.01195
20	V max.=36	9	0.01076	2.5

Middle Channel, f₀ =836.6 MHz(16-QAM)				
Temperature (°C)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	12	11	0.01315	2.5
-20		11	0.01315	2.5
-10		10	0.01195	2.5
0		9	0.01076	2.5
10		8	0.00956	2.5
20		7	0.00837	2.5
30		7	0.00837	2.5
40		8	0.00956	2.5
50		10	0.01195	2.5
20		V min.= 9	9	0.01076
20	V max.=36	10	0.01195	2.5

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