




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

For

Bolt Modus Corp

Oficina N.33 Edificio Ofidepositos Central, Calidonia - Distrito Federal, Panama

FCC ID: 2APW4LIV1S

Report Type: Original Report	Product Type: Mobile Phone
Report Number: <u>RSZ201224001-00D</u>	
Report Date: <u>2021-01-21</u>	
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Reviewed By: <u>RF Engineer</u>	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Mobile Phone
Tested Model	LIV 1S
Frequency Range	EGSM850/WCDMA850: 824-849 MHz (TX), 869-894 MHz (RX) PCS1900/WCDMA1900: 1850-1910 MHz (TX), 1930-1990 MHz (RX)
Conducted Average Power	EGSM850: 33.23dBm, WCDMA850: 22.85dBm PCS1900: 28.89dBm, WCDMA1900: 22.28dBm
Modulation Technique	2G: GMSK 3G: BPSK, QPSK, 16QAM
Antenna Specification*	GSM850/ WCDMA850: 0.7dBi; GSM1900/ WCDMA1900:1.3dBi (It is provided by the applicant)
Voltage Range	DC 3.8V from battery or DC 5.0V from adapter
Date of Test	2021-01-08 to 2021-01-10
Sample serial number	RSZ201224001-RF-S1(Assigned by BACL, Shenzhen)
Received date	2020-12-24
Sample/EUT Status	Good condition
Adapter information	Model: CLIV1S Input: AC 100-264V, 0.25A ~50/60Hz Output: DC 5.0V, 0.7A

Objective

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

The objective is to determine the compliance 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.

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

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

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF output power, conducted		±0.73dB
Unwanted Emission, conducted		±1.6dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±1°C
Humidity		±6%
Supply voltages		±0.4%

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

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

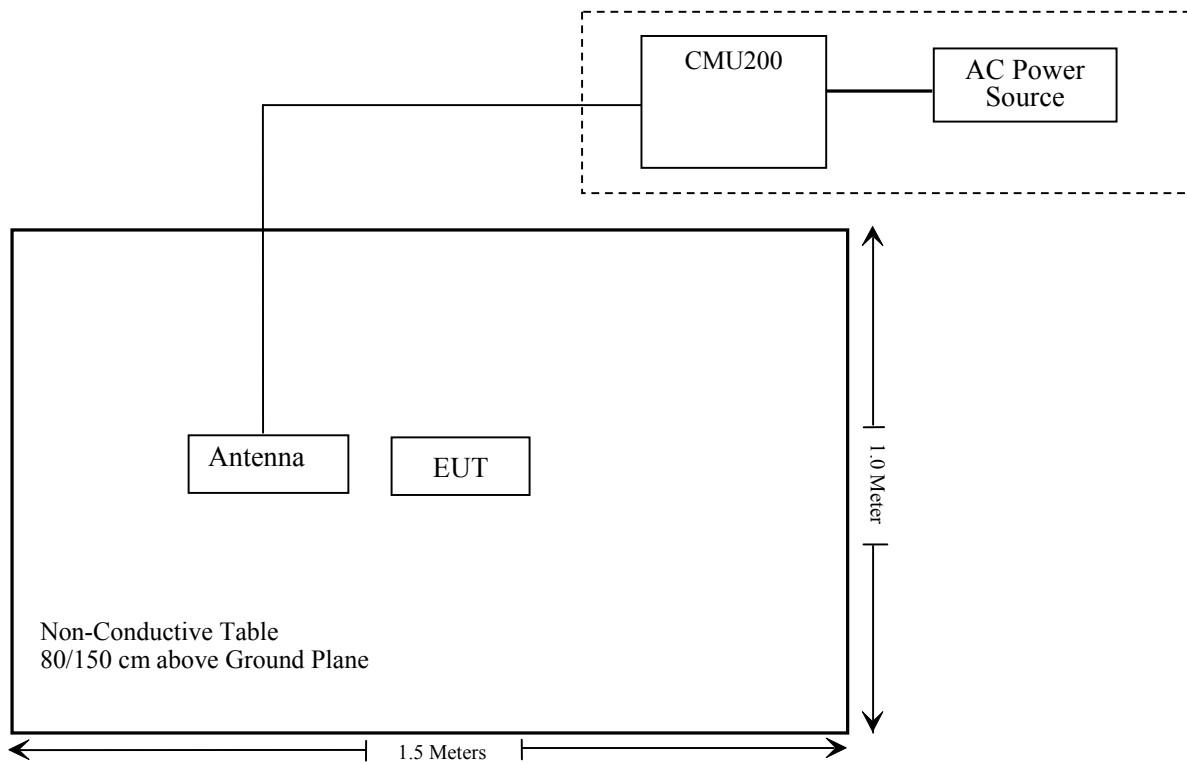
Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	110605

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307, §2.1093	RF Exposure (SAR)	Compliance*
§2.1046; § 22.913 (a); § 24.232 (c)	RF Output Power	Compliance
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; § 22.905; § 22.917; § 24.238	Occupied Bandwidth	Compliance
§ 2.1051; § 22.917 (a); § 24.238 (a)	Spurious Emissions at Antenna Terminal	Compliance
§ 2.1053; § 22.917 (a); § 24.238 (a)	Field Strength of Spurious Radiation	Compliance
§ 22.917 (a); § 24.238 (a)	Band Edge	Compliance
§ 2.1055; § 22.355; § 24.235	Frequency stability	Compliance

Compliance*: Please refer to SAR report released by BACL, report number: RSZ201224001-SA.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2020/08/04	2021/08/03
Sonoma instrument	Pre-amplifier	310 N	186238	2020/08/04	2021/08/03
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2020/12/22	2023/12/21
COM-POWER	Dipole Antenna	AD-100	721027	NCR	NCR
Unknown	Cable 2	RF Cable 2	F-03-EM197	2020/11/29	2021/11/28
Unknown	Cable	Chamber Cable 1	F-03-EM236	2020/11/29	2021/11/28
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/08/04	2021/08/03
COM-POWER	Pre-amplifier	PA-122	181919	2020/11/29	2021/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/29	2021/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2020/12/22	2023/12/21
A.H.System	Horn Antenna	SAS-200/571	135	2018/09/01	2021/08/31
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2020/11/29	2021/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2020/11/29	2021/11/28
MICRO-TRONICS	Passband filter	HPM50111	F-19-EM006	2020/04/20	2021/04/19
Unknown	High Pass filter	1.3GHz	101120	2020/04/20	2021/04/19
Rohde & Schwarz	Wideband Radio Communication Tester	CMU200	106891	2020/10/23	2021/10/22
Agilent	Signal Generator	N5183A	MY51040755	2020/01/14	2021/01/13

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2020/04/03	2021/04/02
Unknown	RF Cable	Unknown	2301 276	2020/11/29	2021/11/28
Weinschel	Power divider	1515	RH386	2020/04/20	2021/04/19
Rohde & Schwarz	Wideband Radio Communication Tester	CMU200	106891	2020/10/23	2021/10/22
ESPEC	Temperature & Humidity Chamber	EL-10KA	9107726	2021/01/05	2022/01/04
instek	DC Power Supply	GPS-3030DD	EM832096	NCR	NCR
Fluke	Digital Multimeter	287	19000011	2020/07/23	2021/07/22

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Shenzhen) 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(b) & §2.1093 - RF EXPOSURE INFORMATION

Applicable Standard

FCC§1.1310 and §2.1093.

Test Result

Compliance, please refer to the SAR report: RSZ201224001-SA.

FCC §2.1047 - MODULATION CHARACTERISTIC

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

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

Applicable Standard

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

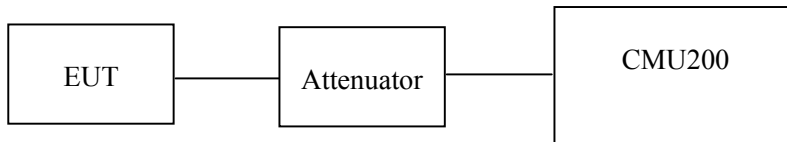
According to FCC §2.1046 and §24.232 (C), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

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

Test Procedure

Conducted method:

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



Radiated method:

ANSI C63.26-2015 section 5.5.3.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	55 %
ATM Pressure:	100.0 kPa

The testing was performed by Black Chen on 2021-01-08.

Conducted Power

Cellular Band (Part 22H)

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)	ERP(dBm)	Limit (dBm)
GSM	128	824.2	32.05	30.10	38.45
	190	836.6	32.16	30.21	38.45
	251	848.8	32.23	30.28	38.45

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				ERP(dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	1 slot	2 slots	3 slots	4 slots	
GPRS	128	824.2	32.05	30.18	28.44	26.75	30.10	28.23	26.49	24.80	38.45
	190	836.6	32.15	30.31	28.59	26.90	30.20	28.36	26.64	24.95	38.45
	251	848.8	32.19	30.42	28.70	27.00	30.24	28.47	26.75	25.05	38.45

Mode	Test Mode	3GPP Sub Test	Average Output Power (dBm)			ERP(dBm)		
			Low	Mid	High	Low	Mid	High
WCDMA (Band 5)	RMC12.2k		22.18	22.85	21.93	20.23	20.90	19.98
	HSDPA	1	20.78	20.20	20.18	18.83	18.25	18.23
		2	20.77	20.21	20.17	18.82	18.26	18.22
		3	20.71	20.24	20.21	18.76	18.29	18.26
		4	20.75	20.18	20.18	18.80	18.23	18.23
	HSUPA	1	20.65	20.09	20.25	18.70	18.14	18.30
		2	20.63	20.05	20.18	18.68	18.10	18.23
		3	20.67	20.11	20.22	18.72	18.16	18.27
		4	20.61	20.13	20.25	18.66	18.18	18.30
		5	20.66	20.07	20.19	18.71	18.12	18.24
	HSPA+	1	20.75	20.16	20.18	18.80	18.21	18.23

Note: ERP(dBm) = Conducted Power(dBm) + Antenna Gain(dBd) – Cable Loss(dB)
 For GSM850 / WCDMA Band5: Antenna Gain = 0.7dBi = -1.45dBd (0dBd=2.15dBi)
 Cable Loss=0.5dB* (provided by the applicant)
 Limit: ERP≤38.45dBm

PCS Band (Part 24E)

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)	EIRP(dBm)	Limit (dBm)
GSM	512	1850.2	28.71	29.21	33
	661	1880.0	28.71	29.21	33
	810	1909.8	28.89	29.39	33

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				EIRP(dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	1 slot	2 slots	3 slots	4 slots	
GPRS	512	1850.2	28.67	26.56	25.19	23.21	29.17	27.06	25.69	23.71	33
	661	1880.0	28.68	26.56	25.13	23.19	29.18	27.06	25.63	23.69	33
	810	1909.8	28.86	26.73	25.30	23.36	29.36	27.23	25.80	23.86	33

Mode	Test Mode	3GPP Sub Test	Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
WCDMA (Band II)	RMC12.2k		22.23	22.28	21.78	22.73	22.78	22.28
	HSDPA	1	20.65	19.75	19.86	21.15	20.25	20.36
		2	20.61	19.77	19.84	21.11	20.27	20.34
		3	20.67	19.71	19.82	21.17	20.21	20.32
		4	20.59	19.69	19.78	21.09	20.19	20.28
	HSUPA	1	20.31	19.52	19.56	20.81	20.02	20.06
		2	20.29	19.57	19.55	20.79	20.07	20.05
		3	20.25	19.53	19.58	20.75	20.03	20.08
		4	20.35	19.51	19.61	20.85	20.01	20.11
		5	20.33	19.49	19.55	20.83	19.99	20.05
	HSPA+	1	20.27	19.56	19.60	20.77	20.06	20.10

Note: EIRP(dBm) = Conducted Power(dBm) + Antenna Gain(dBi) – Cable Loss(dB)
 For PCS1900 / WCDMA Band2: Antenna Gain = 1.3dBi
 Cable Loss=0.8dB* (provided by the applicant)
 Limit: EIRP≤33dBm

Peak-to-average ratio (PAR)

Cellular Band

Mode	Channel	PAR (dB)	Limit (dB)
GSM	Low	3.22	13
	Middle	3.49	13
	High	3.64	13

Mode	Channel	PAR (dB)	Limit (dB)
RMC (BPSK)	Low	3.67	13
	Middle	3.24	13
	High	3.75	13
HSDPA (16QAM)	Low	3.36	13
	Middle	3.31	13
	High	3.36	13
HSUPA (BPSK)	Low	3.25	13
	Middle	3.41	13
	High	3.54	13
HSPA+	Low	3.33	13
	Middle	3.51	13
	High	3.46	13

PCS Band

Mode	Channel	PAR (dB)	Limit (dB)
GSM	Low	3.25	13
	Middle	3.31	13
	High	3.42	13

Mode	Channel	PAR (dB)	Limit (dB)
RMC (BPSK)	Low	3.53	13
	Middle	3.47	13
	High	3.53	13
HSDPA (16QAM)	Low	3.57	13
	Middle	3.34	13
	High	3.54	13
HSUPA (BPSK)	Low	3.29	13
	Middle	3.41	13
	High	3.38	13
HSPA+	Low	3.48	13
	Middle	3.56	13
	High	3.52	13

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

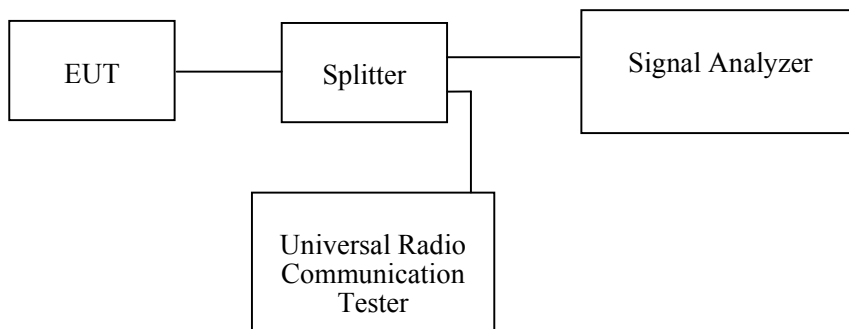
Applicable Standard

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

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 (GSM) & 100 kHz (WCDMA) and the 26 dB & 99% bandwidth was recorded.



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	55 %
ATM Pressure:	100.0 kPa

The testing was performed by Black Chen on 2021-01-10.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to the following tables and plots.

Cellular Band (Part 22H)

Mode	Frequency (MHz)	99% Occupied Bandwidth (kHz)	26 dB Emission Bandwidth (kHz)
GSM(GMSK)	824.2	245.19	314.1
	836.6	248.40	320.51
	848.8	248.40	317.31

	Frequency (MHz)	Occupied Bandwidth (MHz)	26dB Bandwidth (MHz)
RMC	826.4	4.15	4.68
	836.6	4.15	4.68
	846.6	4.15	4.68
HSDPA	826.4	4.13	4.68
	836.6	4.17	4.68
	846.6	4.13	4.65
HSUPA	826.4	4.15	4.68
	836.6	4.15	4.68
	846.6	4.15	4.65

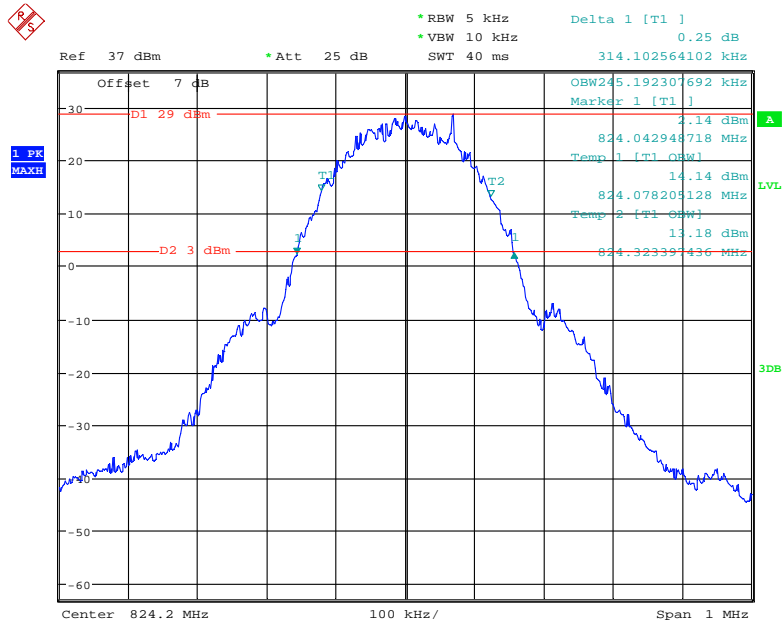
PCS Band (Part 24E)

Mode	Frequency (MHz)	99% Occupied Bandwidth (kHz)	26 dB Emission Bandwidth (kHz)
GSM(GMSK)	1850.2	246.79	315.71
	1880.0	245.19	318.91
	1909.8	254.81	315.71

	Frequency (MHz)	Occupied Bandwidth (MHz)	26dB Bandwidth (MHz)
RMC	1852.4	4.15	4.70
	1880.0	4.17	4.70
	1907.6	4.18	4.70
HSDPA	1852.4	4.13	4.70
	1880.0	4.17	4.71
	1907.6	4.17	4.70
HSUPA	1852.4	4.13	4.70
	1880.0	4.15	4.70
	1907.6	4.17	4.70

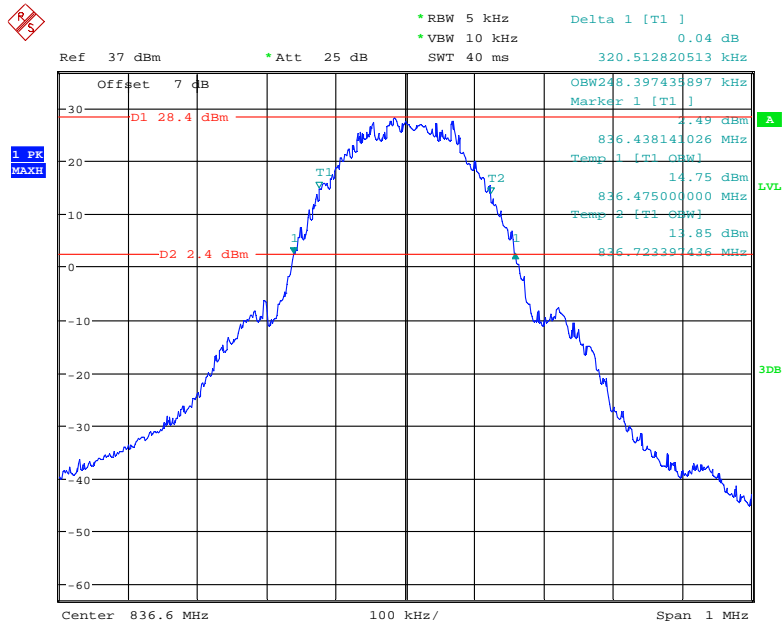
Cellular Band (Part 22H)

26 dB Emissions & 99% Occupied Bandwidth for GSM (GMSK) Mode, Low Channel



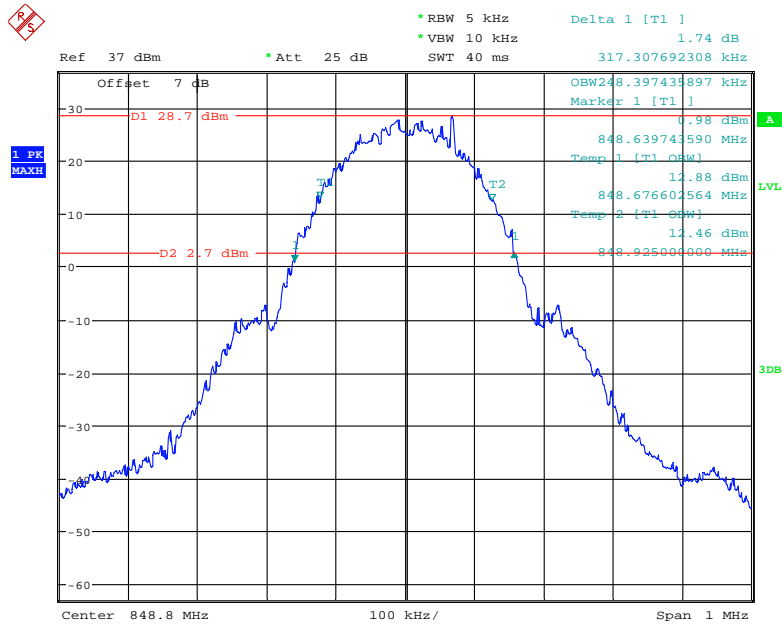
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26 dB Emissions & 99% Occupied Bandwidth for GSM (GMSK) Mode, Middle Channel



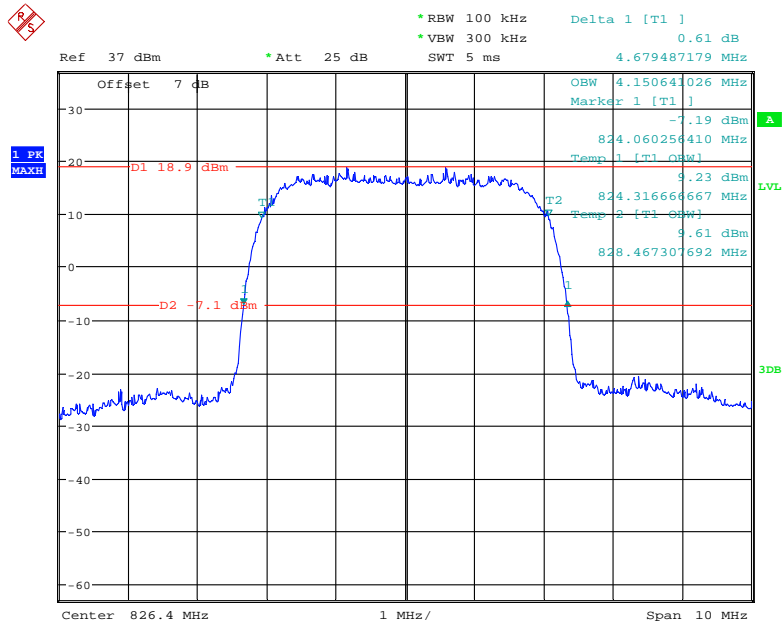
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26 dB Emissions & 99% Occupied Bandwidth for GSM (GMSK) Mode, High Channel



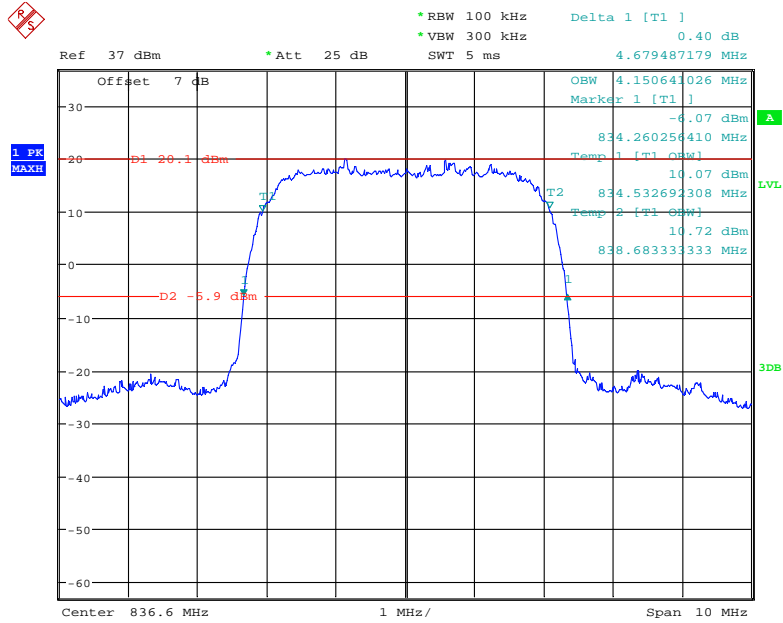
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26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode, Low Channel



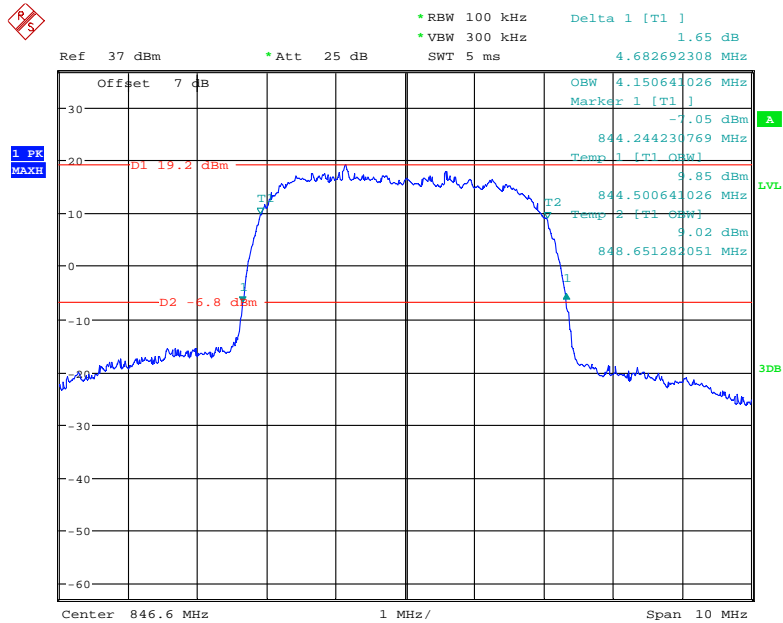
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26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode, Middle Channel



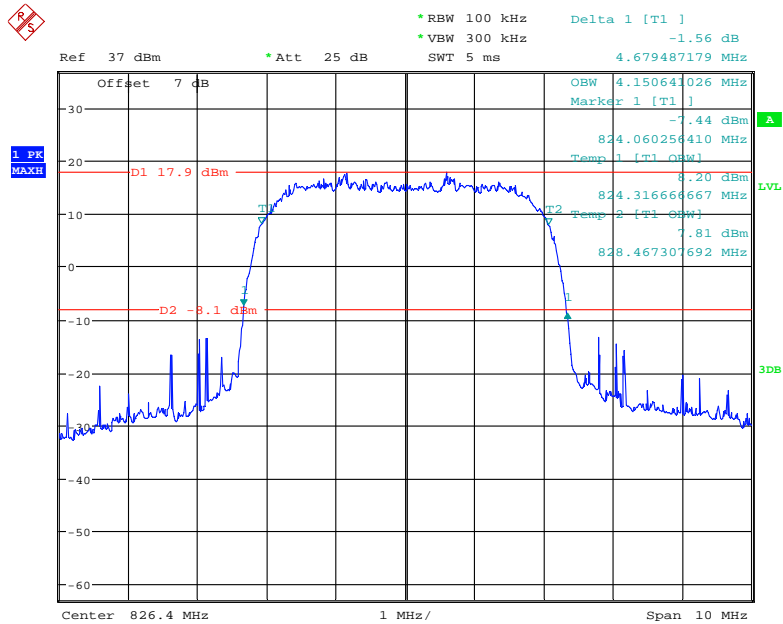
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26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode, High Channel



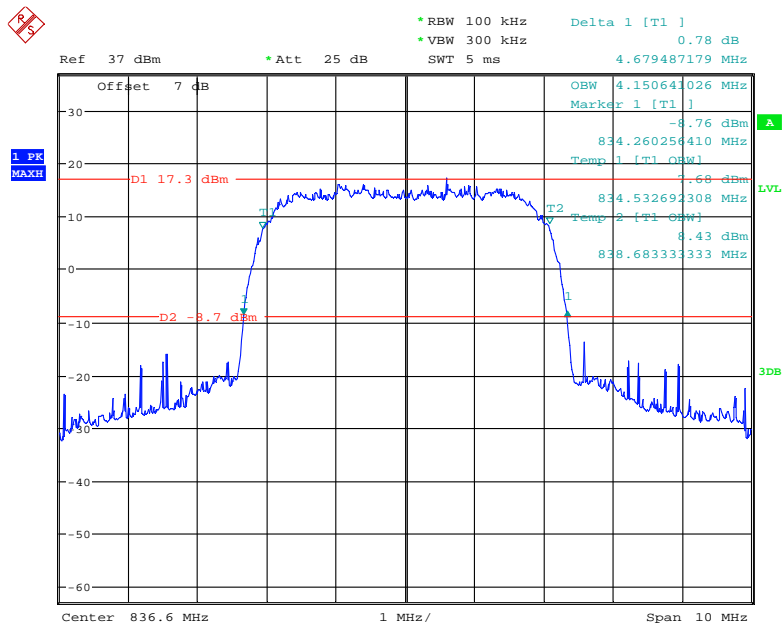
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26 dB Emissions & 99% Occupied Bandwidth for HSUPA (BPSK) Mode, Low Channel



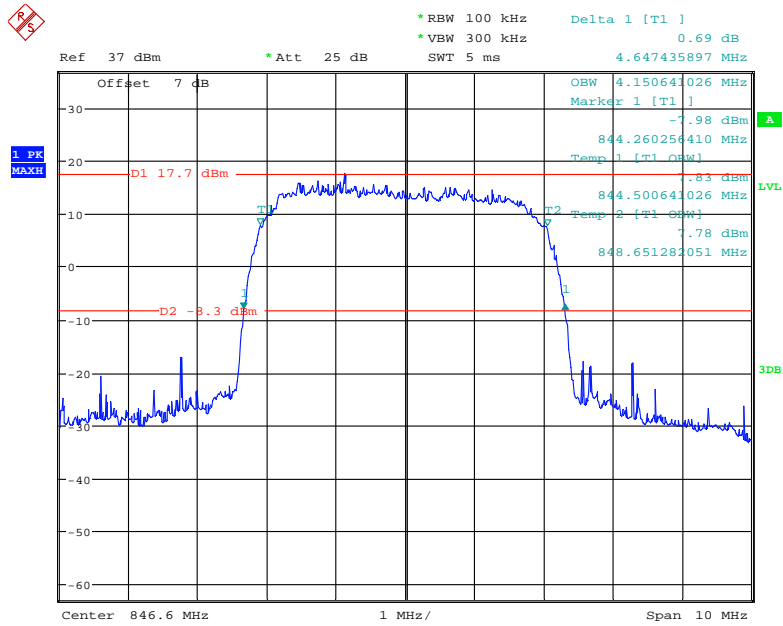
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26 dB Emissions & 99% Occupied Bandwidth for HSUPA (BPSK) Mode, Middle Channel



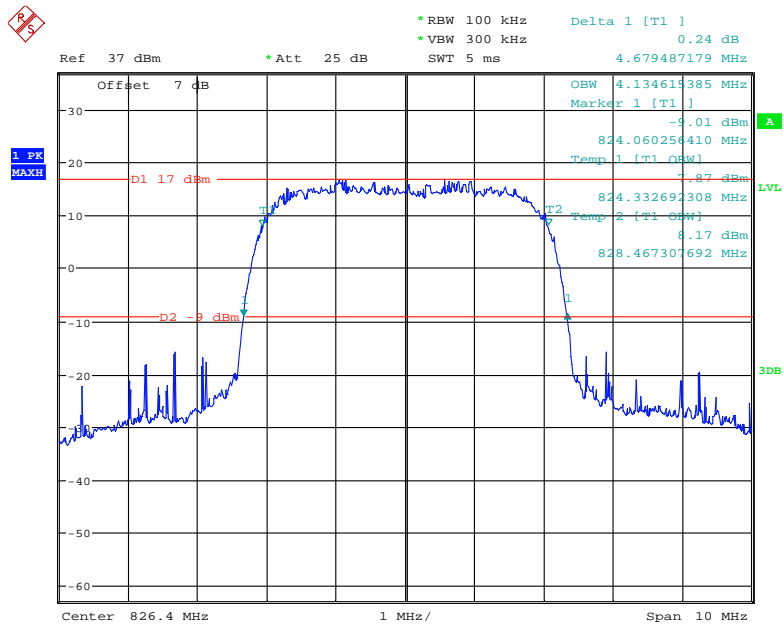
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26 dB Emissions & 99% Occupied Bandwidth for HSUPA (BPSK) Mode, High Channel



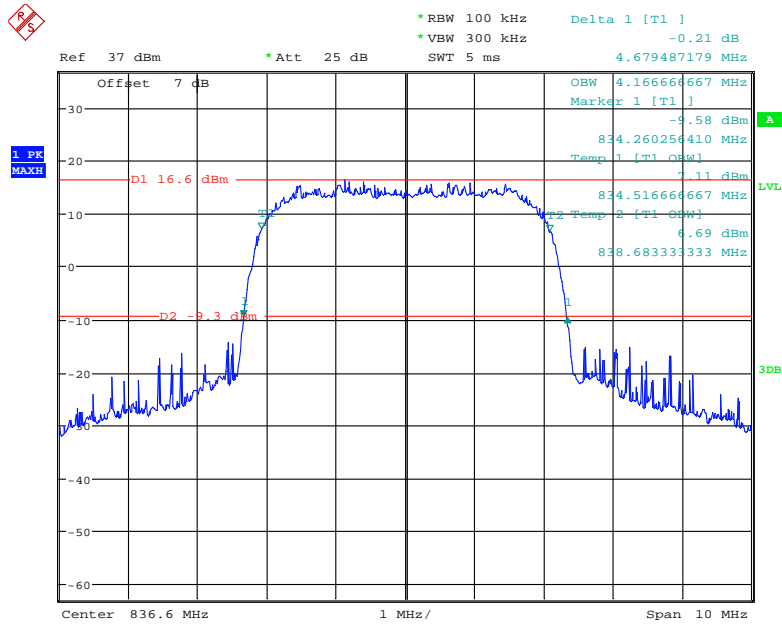
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26 dB Emissions & 99% Occupied Bandwidth for HSDPA (16QAM) Mode, Low Channel



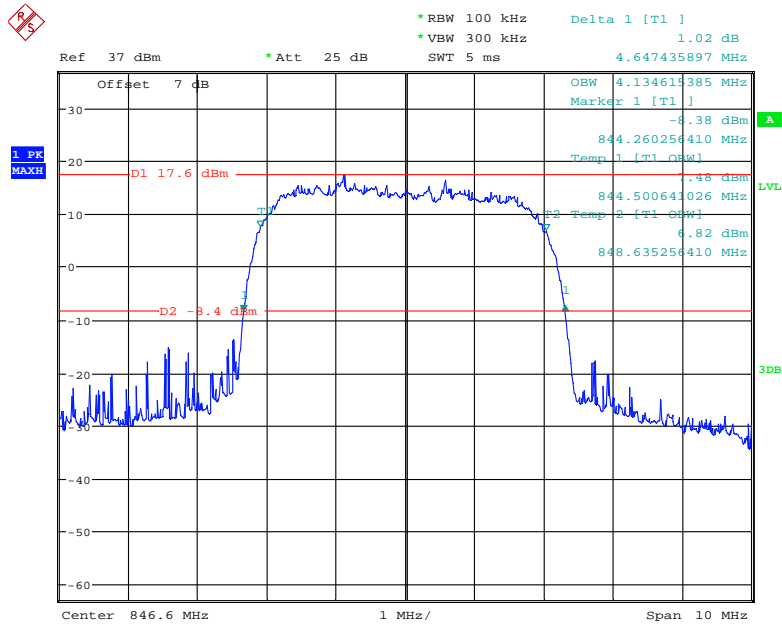
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26 dB Emissions & 99% Occupied Bandwidth for HSDPA (16QAM) Mode, Middle Channel



Date: 10.JAN.2021 18:21:39

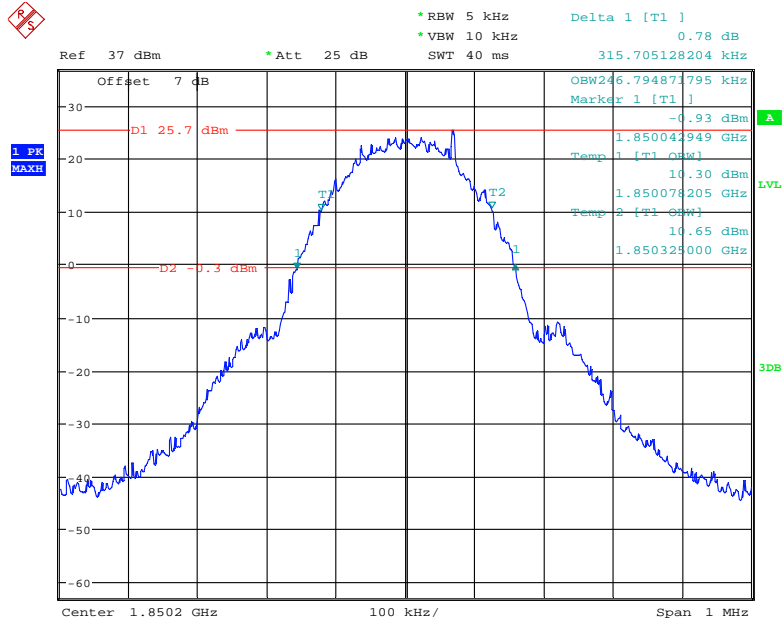
26 dB Emissions & 99% Occupied Bandwidth for HSDPA (16QAM) Mode, High Channel



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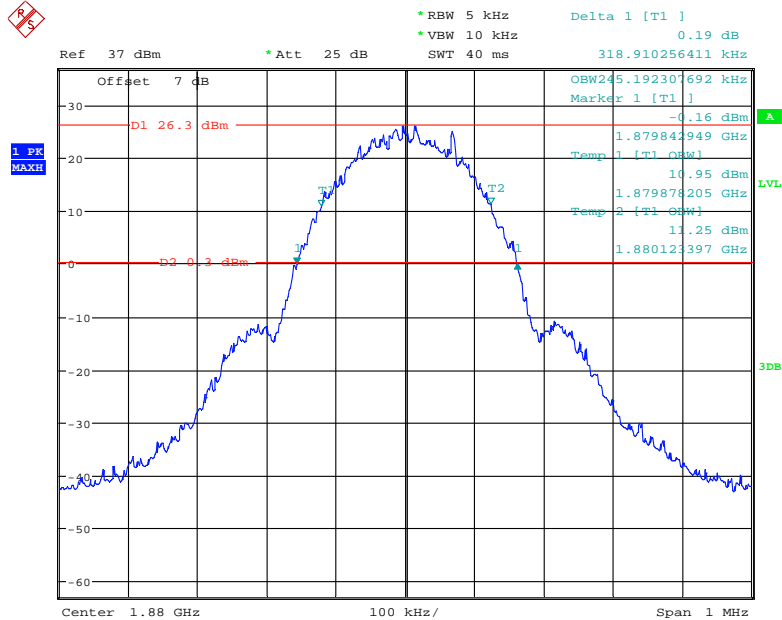
PCS Band (Part 24E)

26 dB Emissions & 99% Occupied Bandwidth for GSM (GMSK) Mode, Low Channel



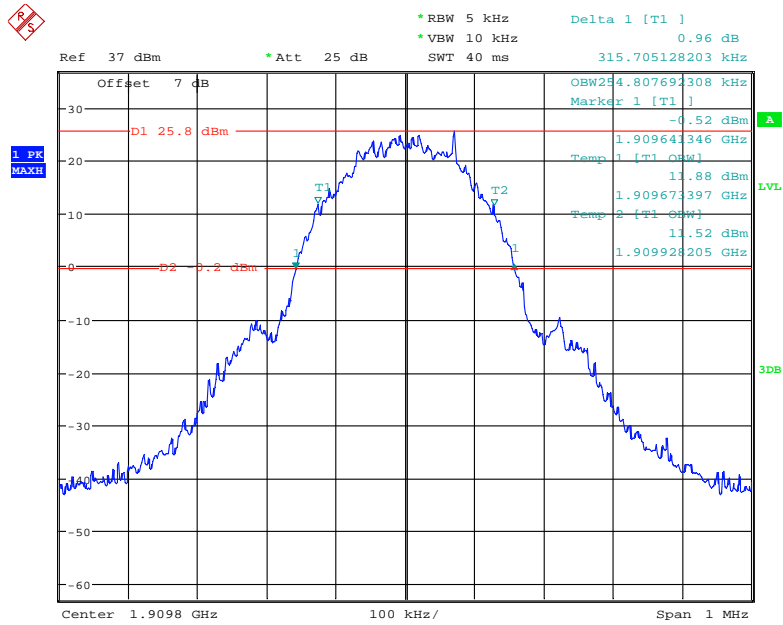
Date: 10.JAN.2021 18:06:45

26 dB Emissions & 99% Occupied Bandwidth for GSM (GMSK) Mode, Middle Channel



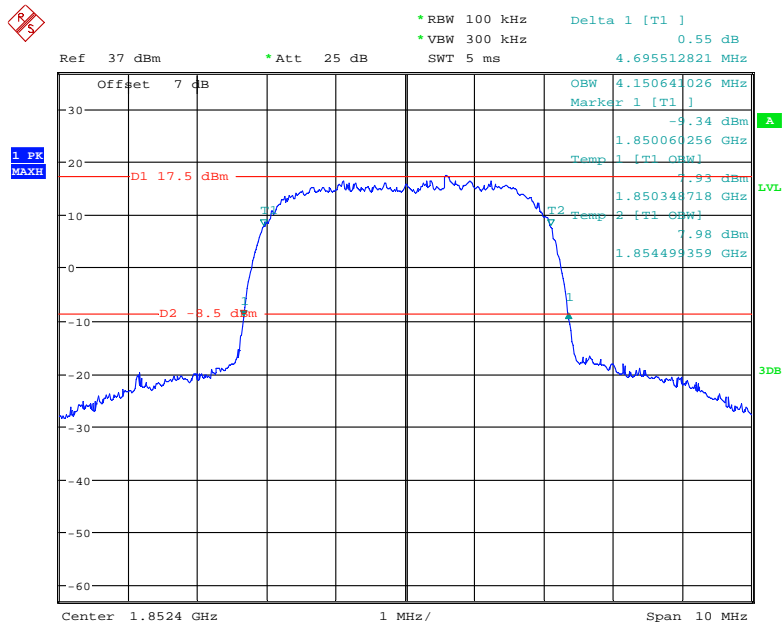
Date: 10.JAN.2021 18:04:15

26 dB Emissions & 99% Occupied Bandwidth for GSM (GMSK) Mode, High Channel



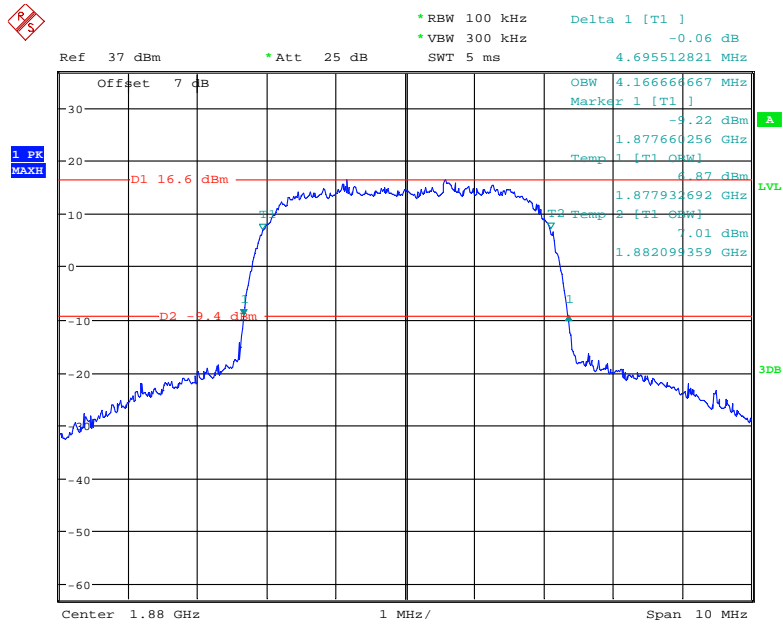
Date: 10.JAN.2021 18:07:40

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



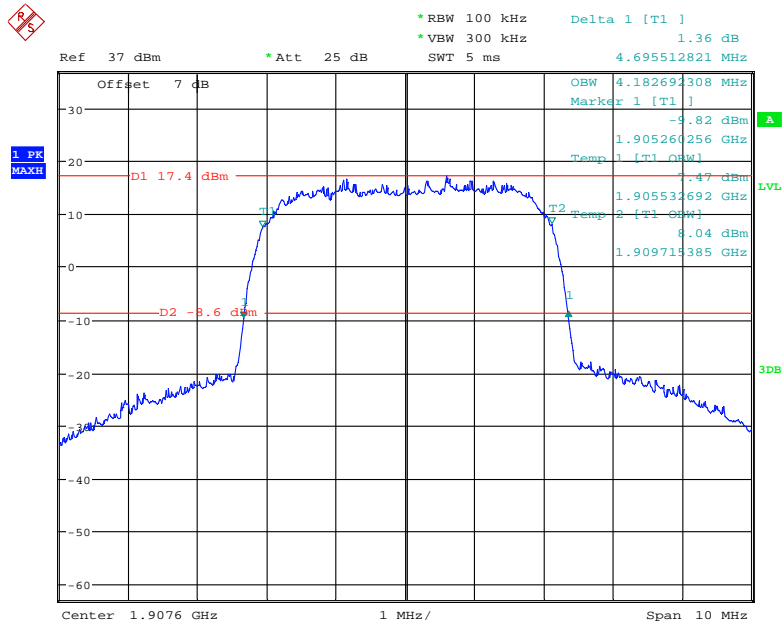
Date: 10.JAN.2021 18:37:18

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



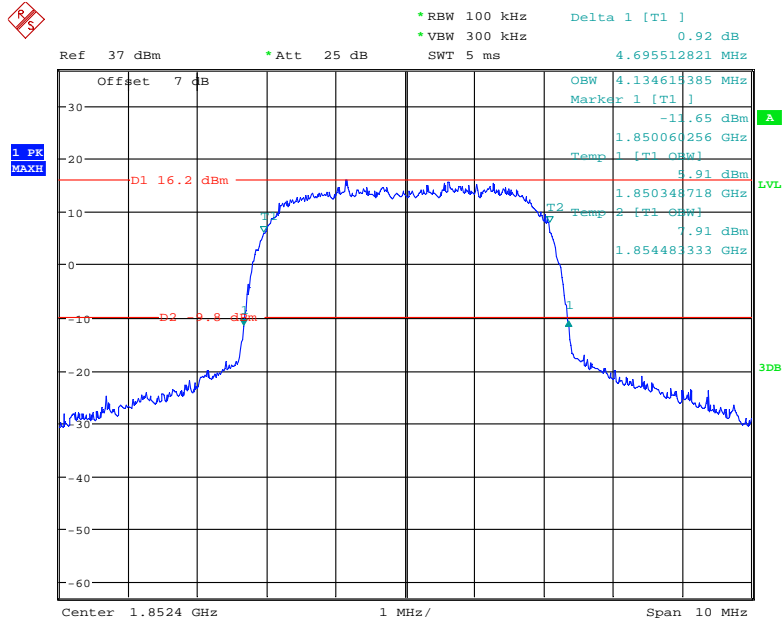
Date: 10.JAN.2021 18:38:51

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



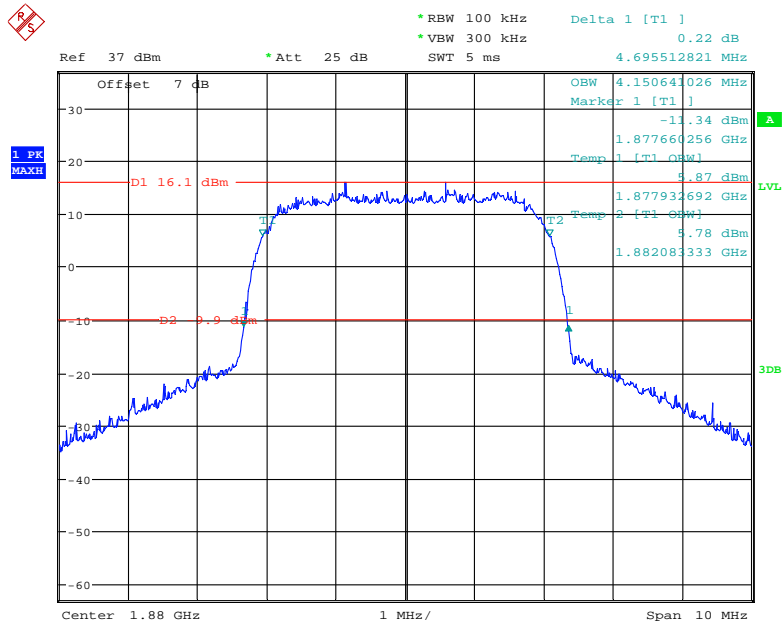
Date: 10.JAN.2021 18:39:44

26 dB Emissions & 99% Occupied Bandwidth for HSUPA (BPSK) Mode, Low Channel



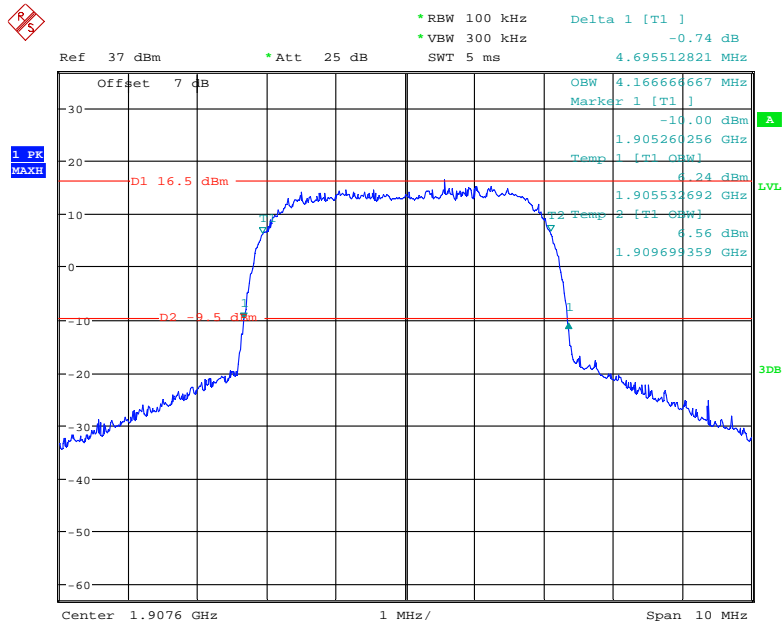
Date: 10.JAN.2021 18:28:30

26 dB Emissions & 99% Occupied Bandwidth for HSUPA (BPSK) Mode, Middle Channel



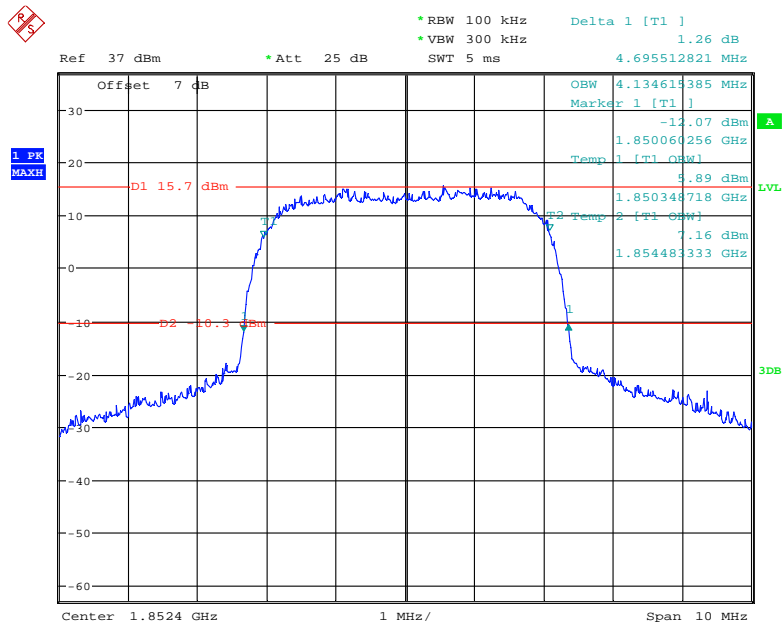
Date: 10.JAN.2021 18:29:12

26 dB Emissions & 99% Occupied Bandwidth for HSUPA (BPSK) Mode, High Channel



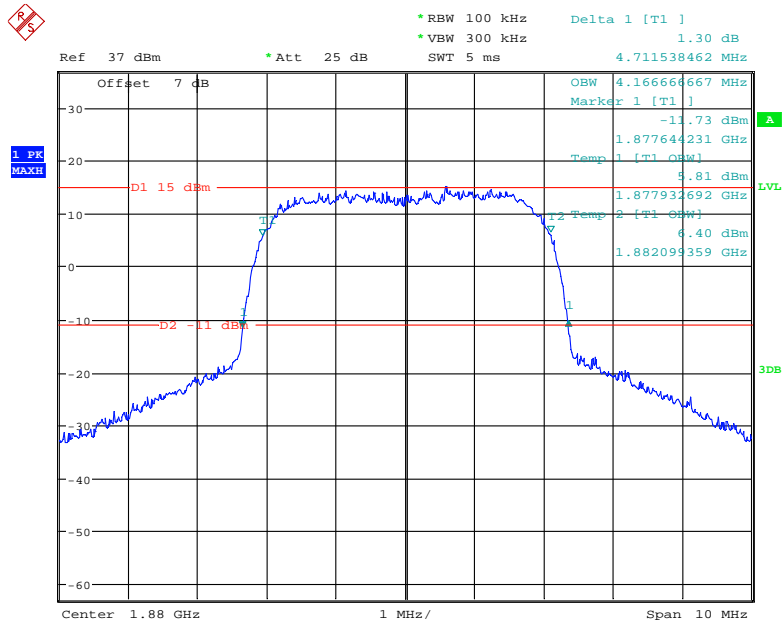
Date: 10.JAN.2021 18:30:54

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



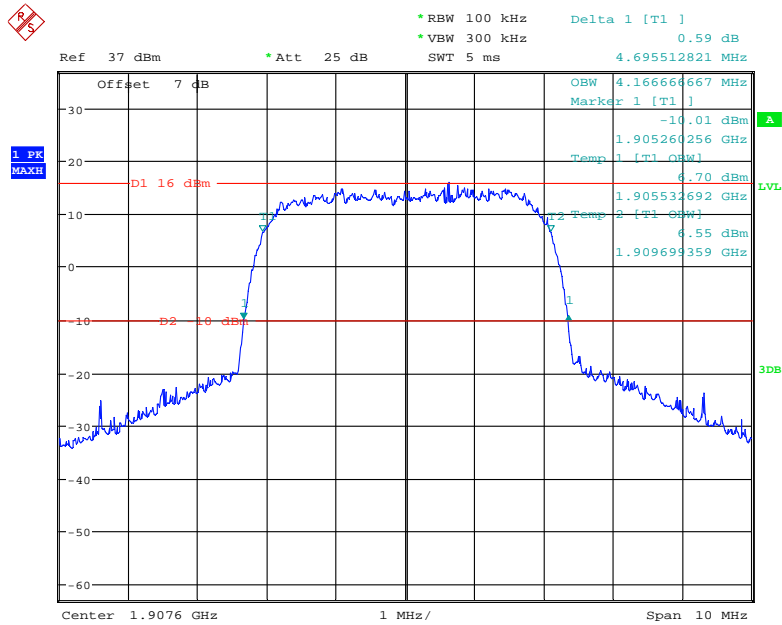
Date: 10.JAN.2021 18:35:02

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



Date: 10.JAN.2021 18:33:54

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



Date: 10.JAN.2021 18:32:47

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

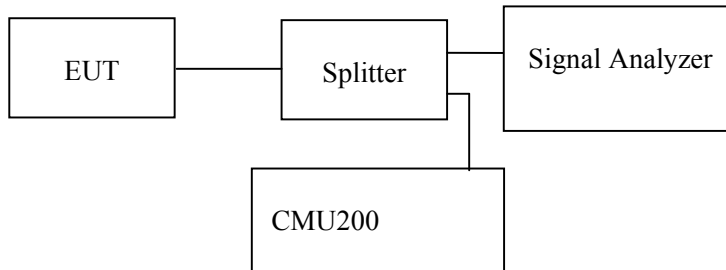
Applicable Standard

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

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



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	55 %
ATM Pressure:	100.0 kPa

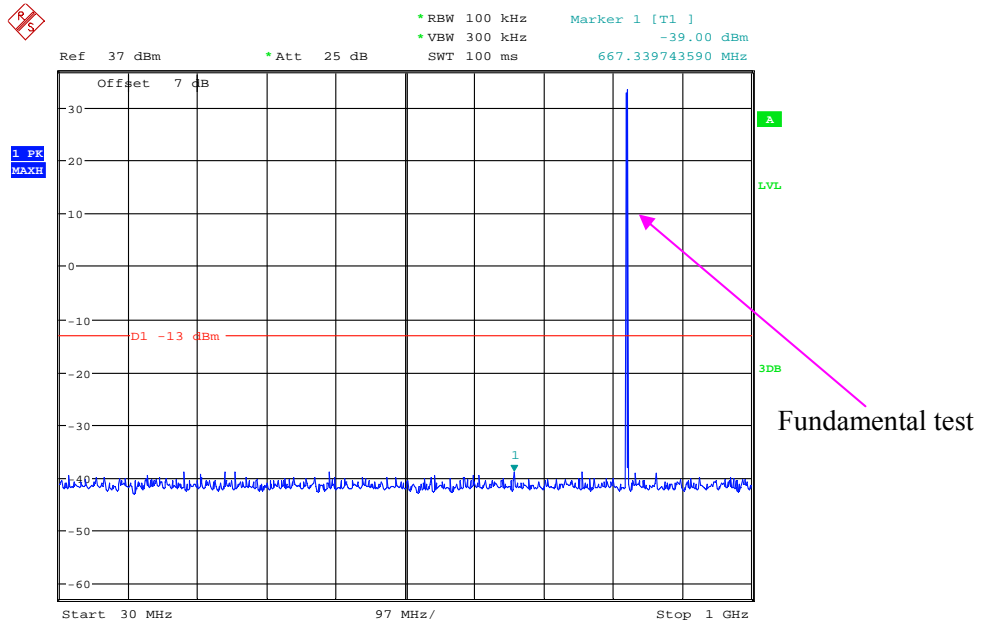
The testing was performed by Black Chen on 2021-01-10.

EUT operation mode: Transmitting

Test result: Compliance, please refer to the following plots.

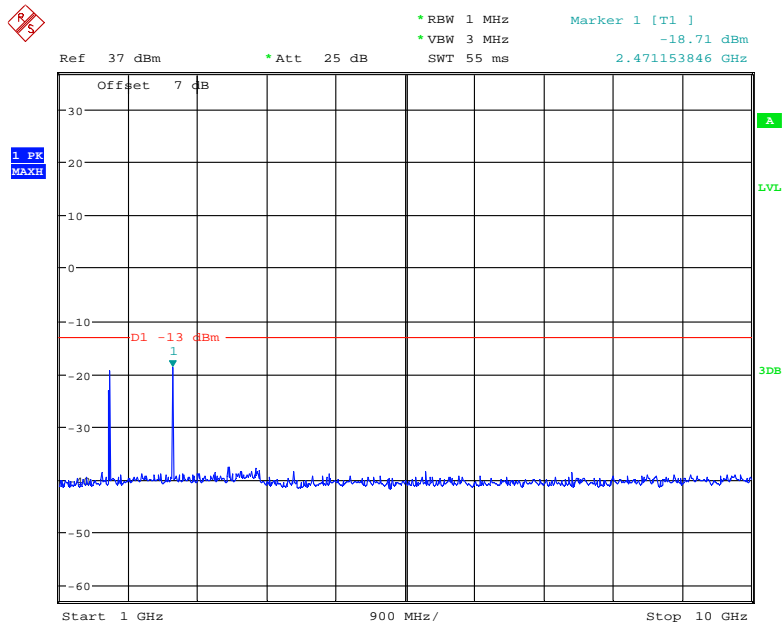
**Cellular Band (Part 22H)
Low Channel**

30 MHz – 1 GHz (GSM Mode)



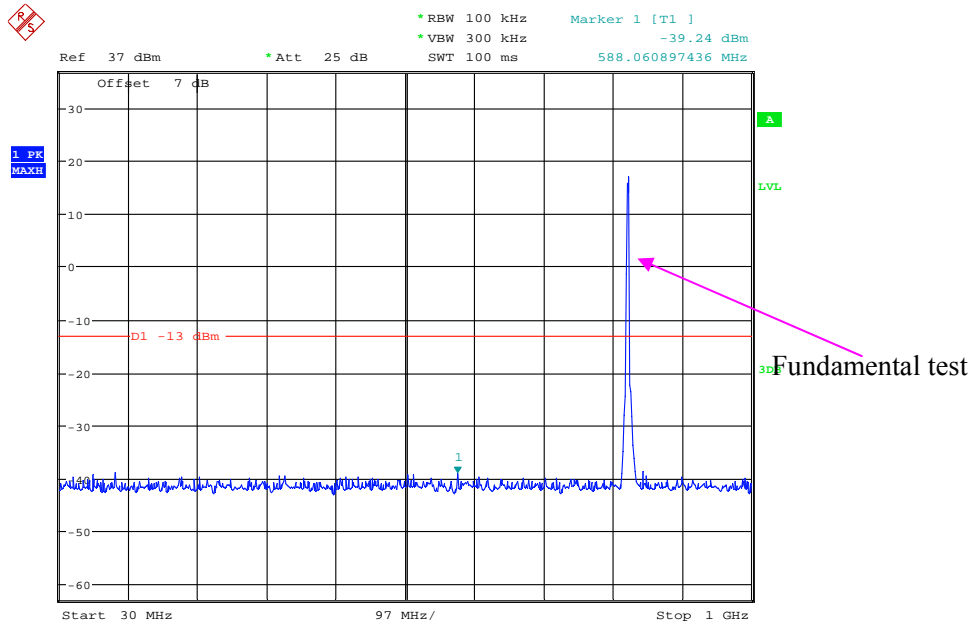
Date: 10.JAN.2021 19:07:18

1 GHz – 10 GHz (GSM Mode)



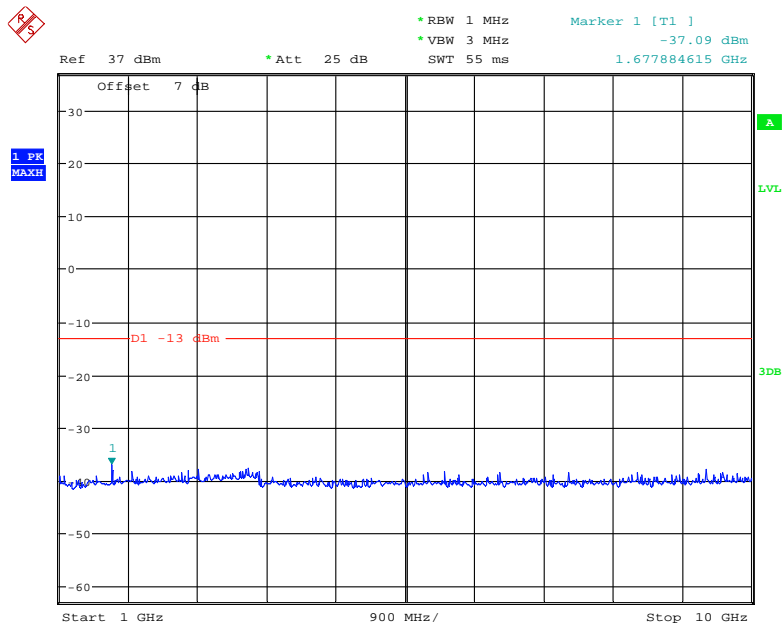
Date: 10.JAN.2021 19:05:24

30 MHz – 1 GHz (WCDMA Mode)



Date: 10.JAN.2021 19:08:25

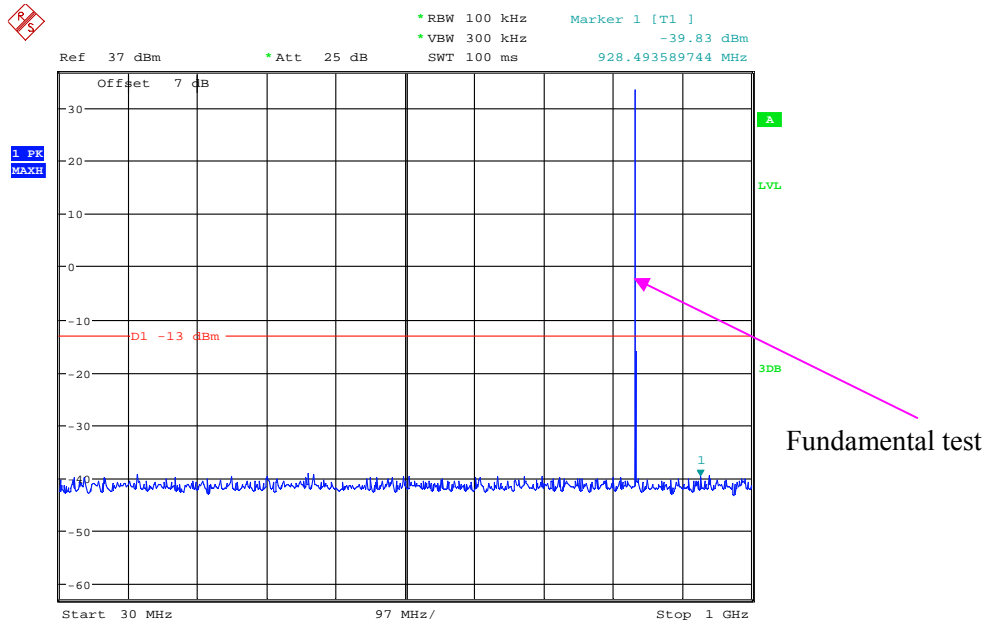
1 GHz – 10GHz (WCDMA Mode)



Date: 10.JAN.2021 19:10:12

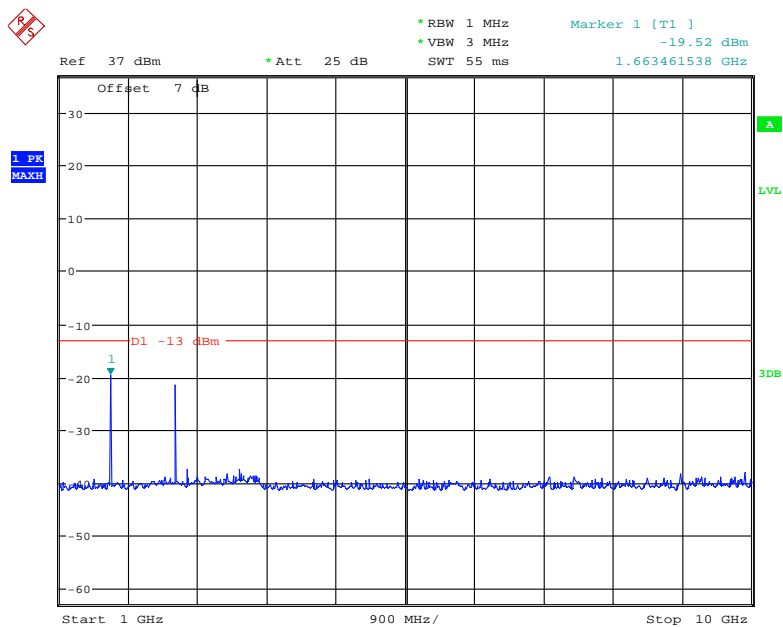
Middle Channel

30 MHz – 1 GHz (GSM Mode)



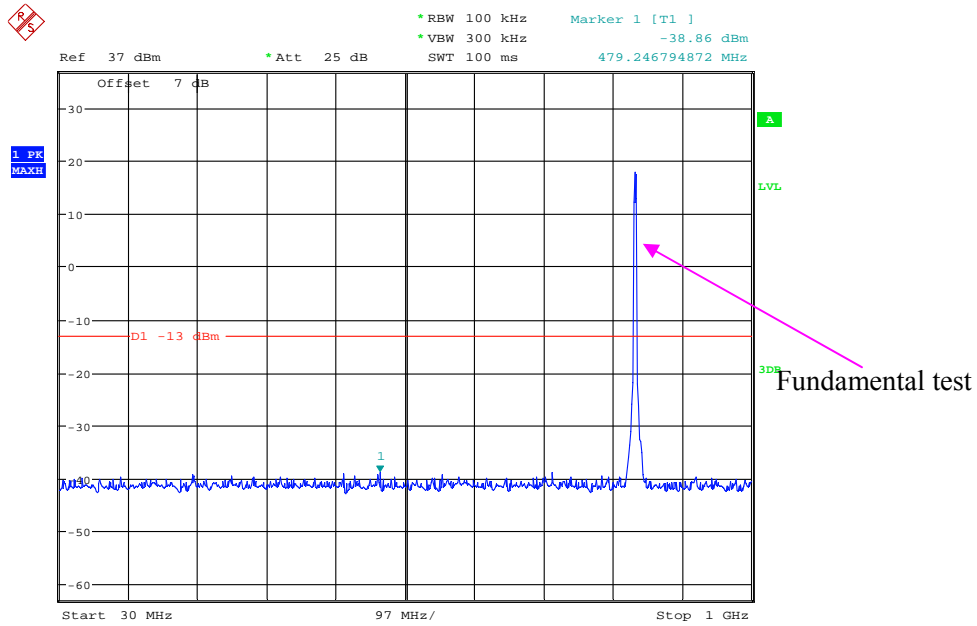
Date: 10.JAN.2021 19:07:04

1 GHz – 10 GHz (GSM Mode)



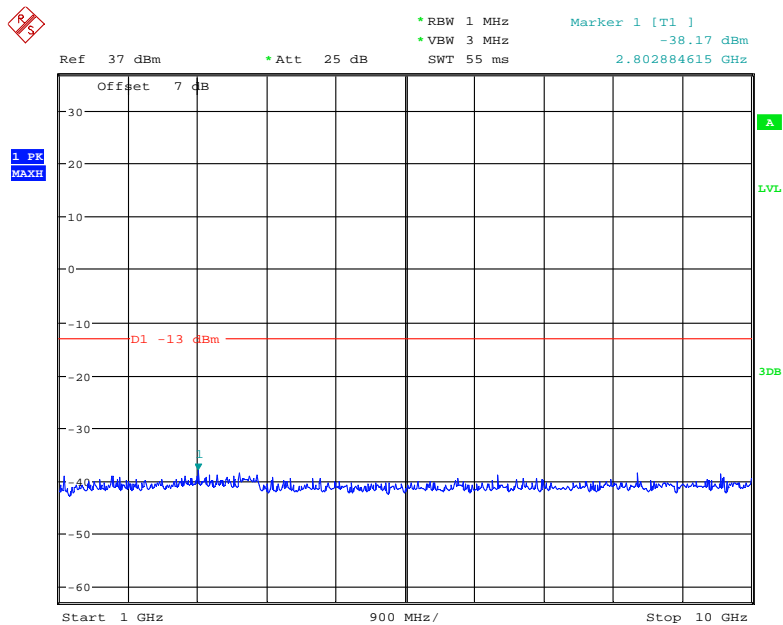
Date: 10.JAN.2021 19:05:54

30 MHz – 1 GHz (WCDMA Mode)



Date: 10.JAN.2021 19:09:02

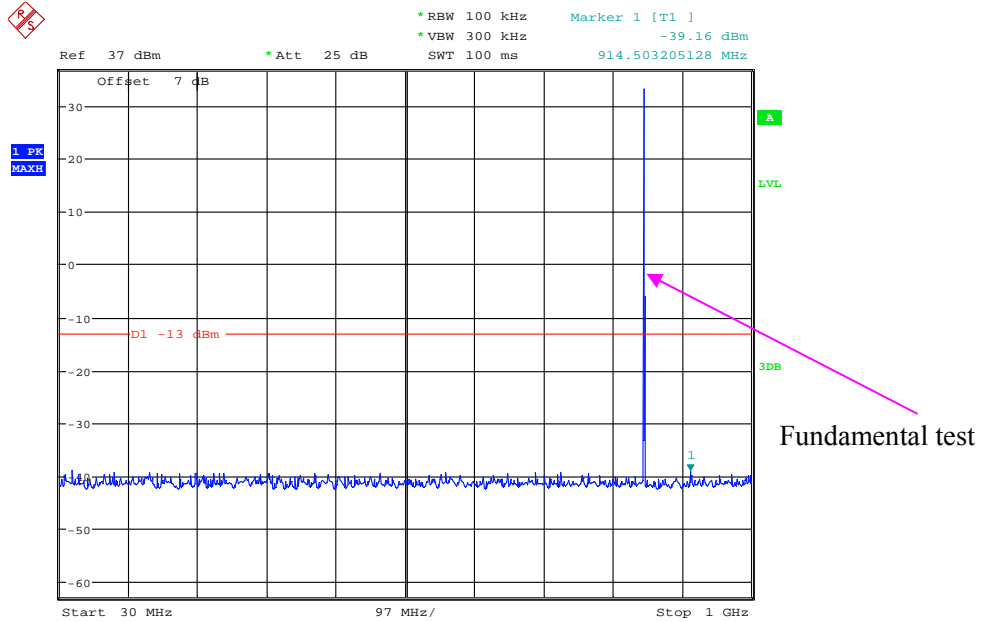
1 GHz – 10 GHz (WCDMA Mode)



Date: 10.JAN.2021 19:10:05

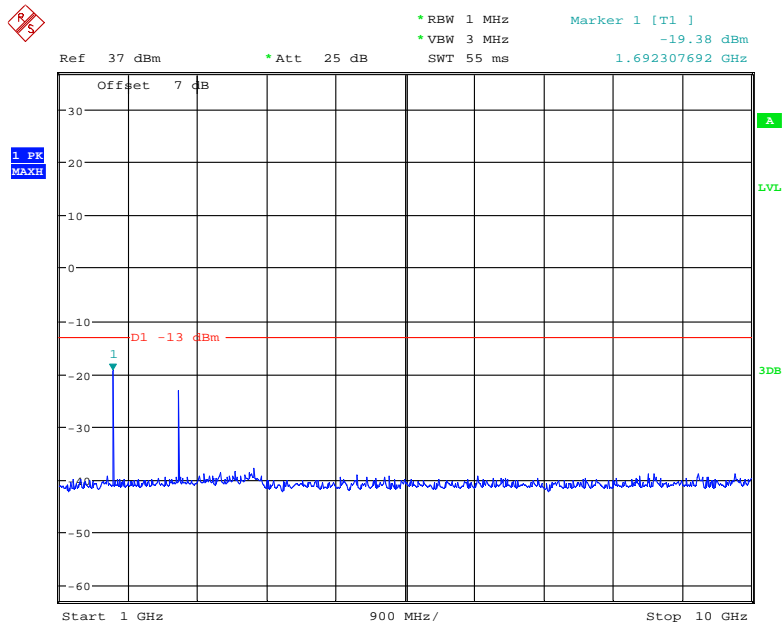
High Channel

30 MHz – 1 GHz (GSM Mode)



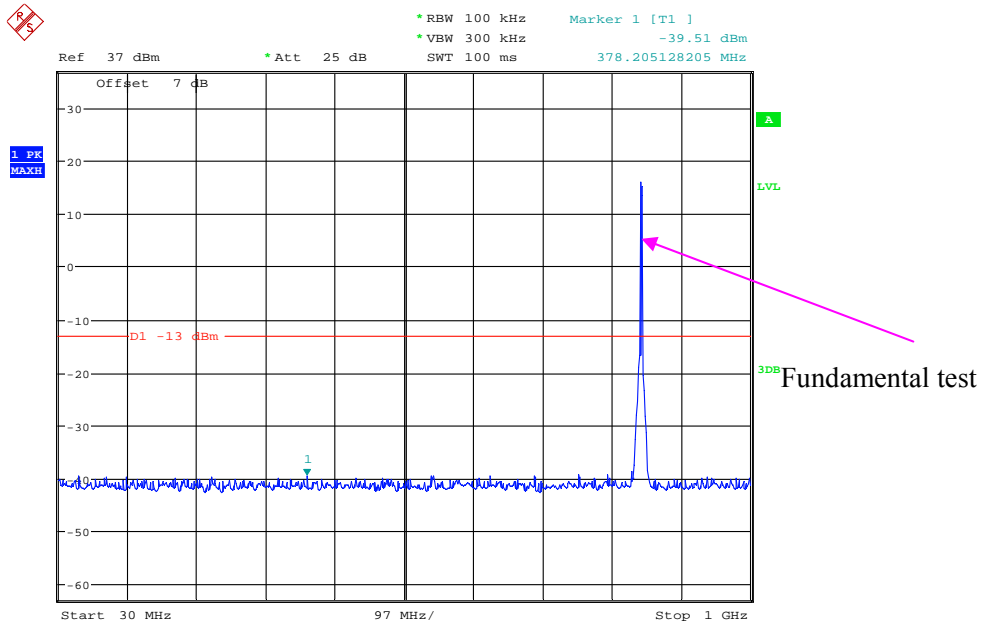
Date: 10.JAN.2021 19:06:41

1 GHz – 10 GHz (GSM Mode)



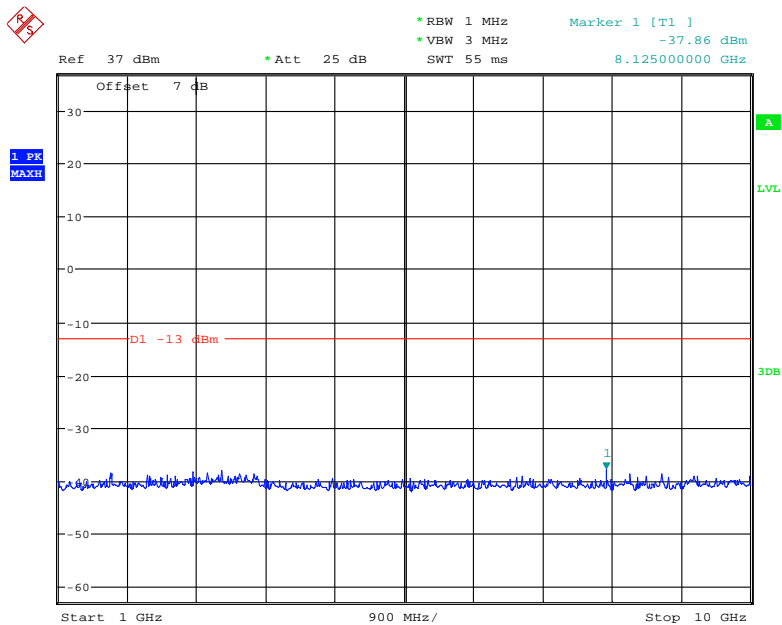
Date: 10.JAN.2021 19:06:07

30 MHz – 1 GHz (WCDMA Mode)



Date: 10.JAN.2021 19:09:20

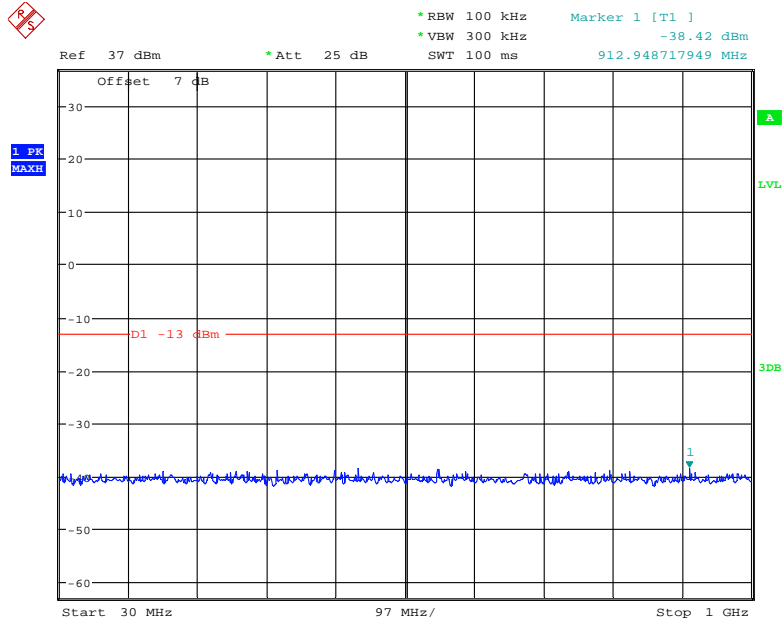
1 GHz – 10 GHz (WCDMA Mode)



Date: 10.JAN.2021 19:09:51

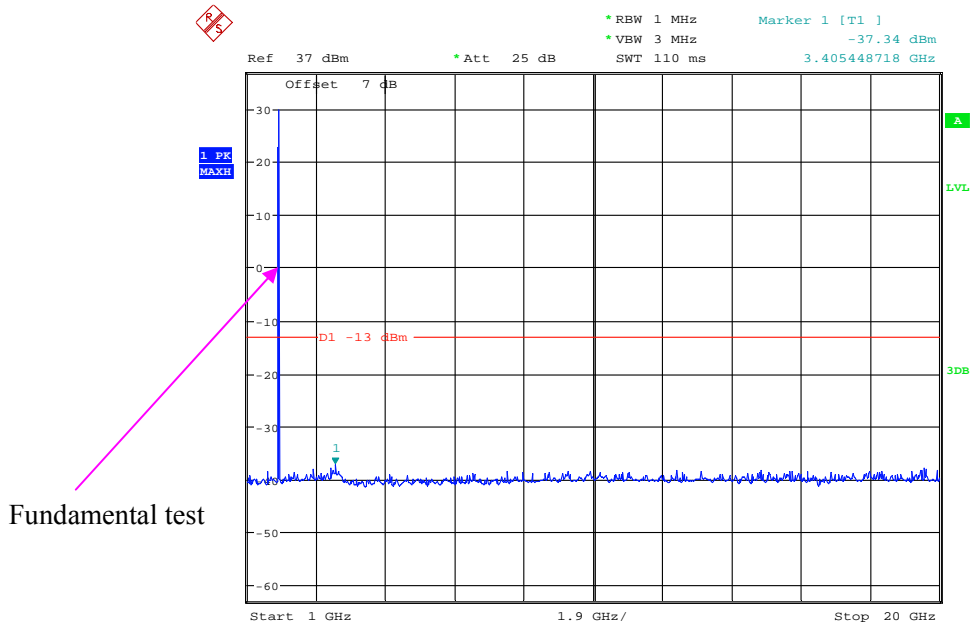
**PCS Band (Part 24E)
Low Channel**

30 MHz – 1 GHz (GSM Mode)



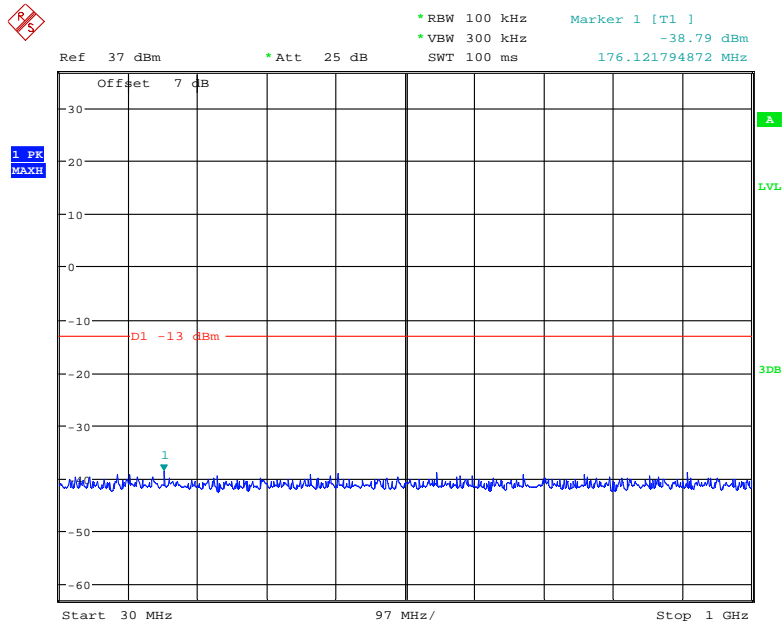
Date: 10.JAN.2021 19:01:22

1 GHz – 20 GHz (GSM Mode)



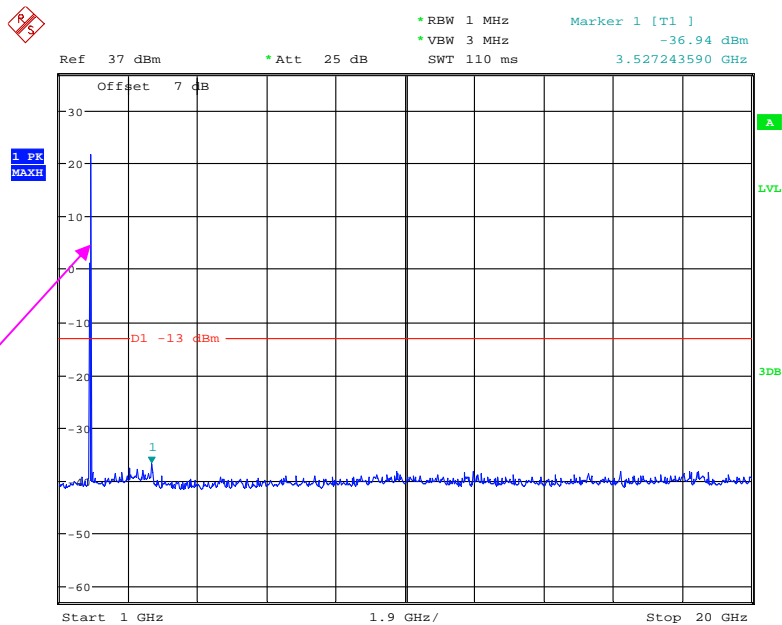
Date: 10.JAN.2021 19:03:35

30 MHz – 1 GHz (WCDMA Mode)



Date: 10.JAN.2021 19:02:43

1 GHz – 20 GHz (WCDMA Mode)

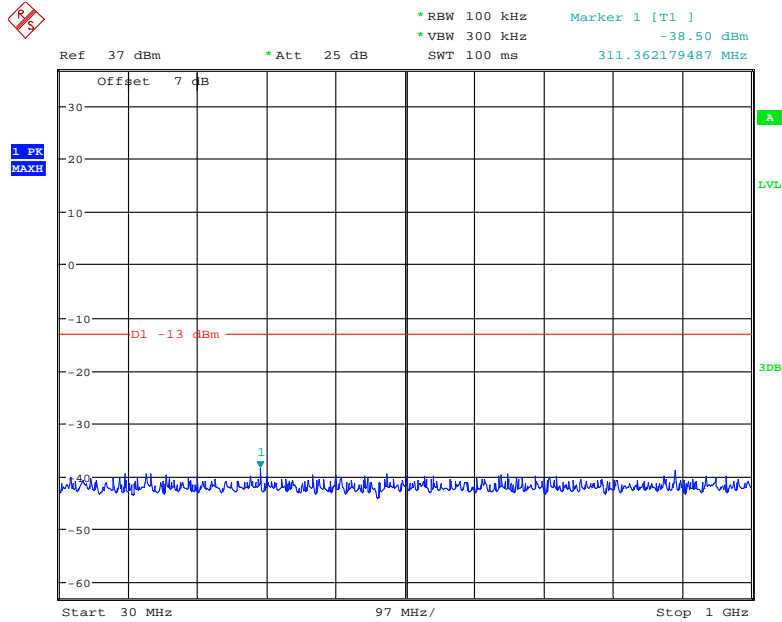


Fundamental test

Date: 10.JAN.2021 19:11:30

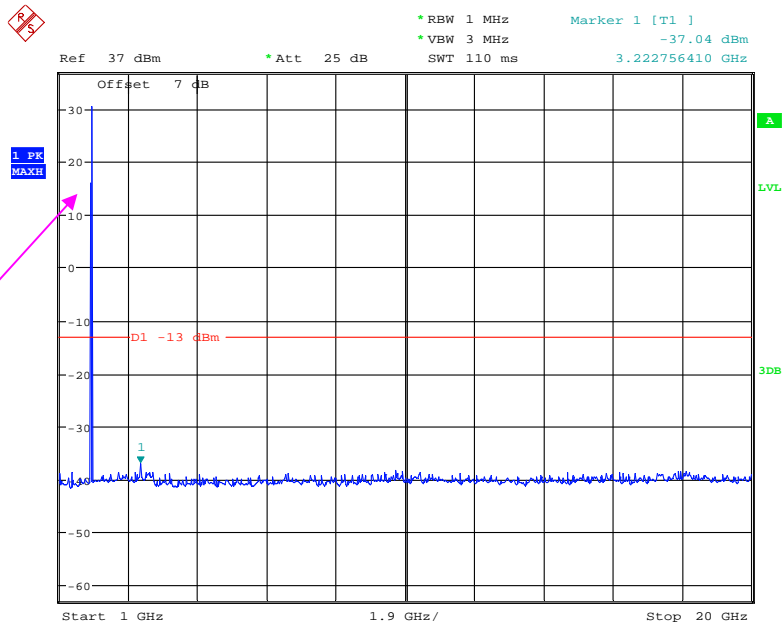
Middle Channel

30 MHz – 1 GHz (GSM Mode)



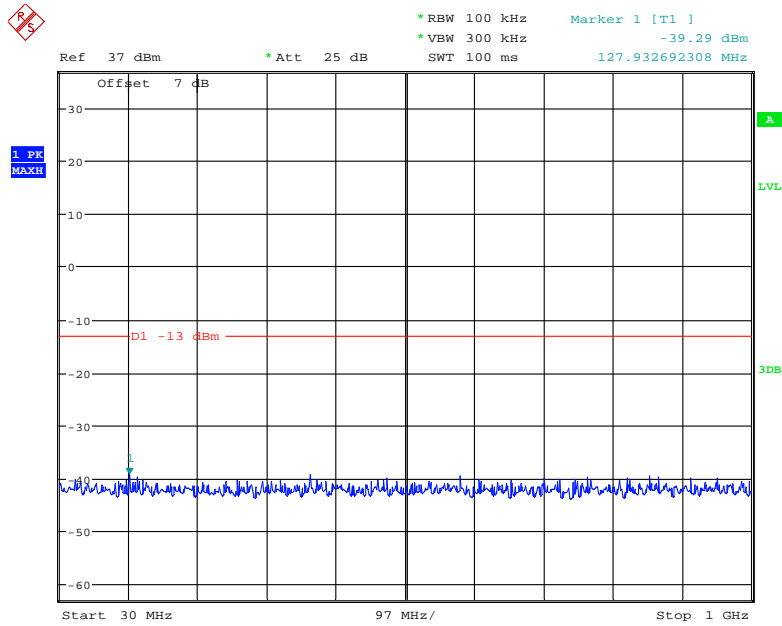
Date: 10.JAN.2021 19:02:02

1 GHz – 20 GHz (GSM Mode)



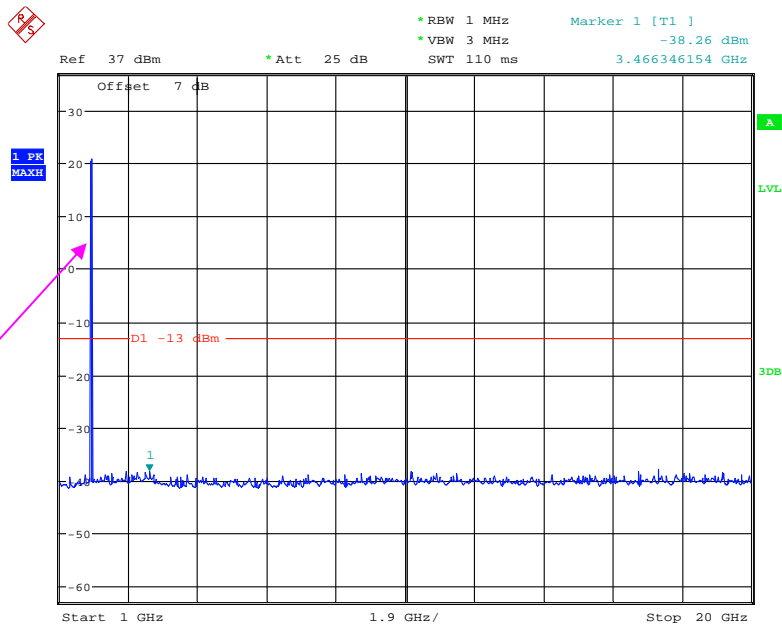
Date: 10.JAN.2021 19:04:05

30 MHz – 1 GHz (WCDMA Mode)



Date: 10.JAN.2021 19:02:36

1 GHz – 20 GHz (WCDMA Mode)

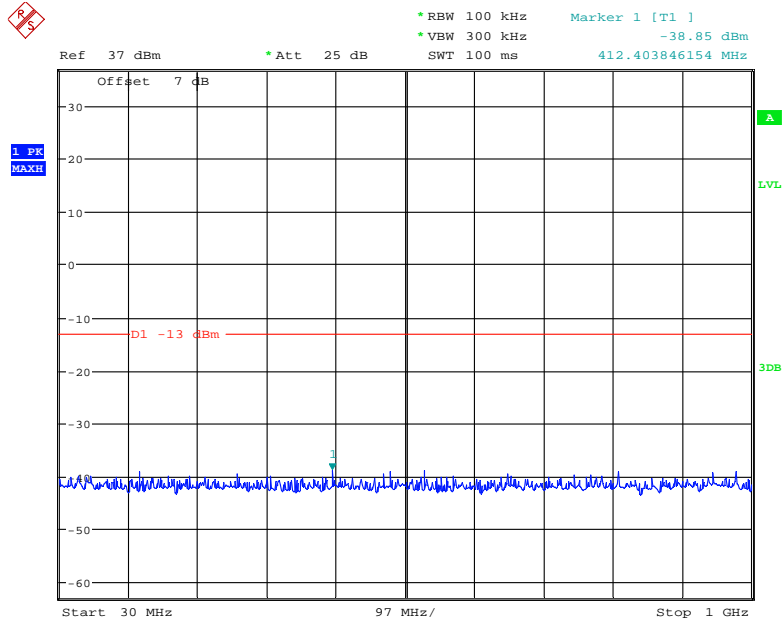


Fundamental test

Date: 10.JAN.2021 19:11:14

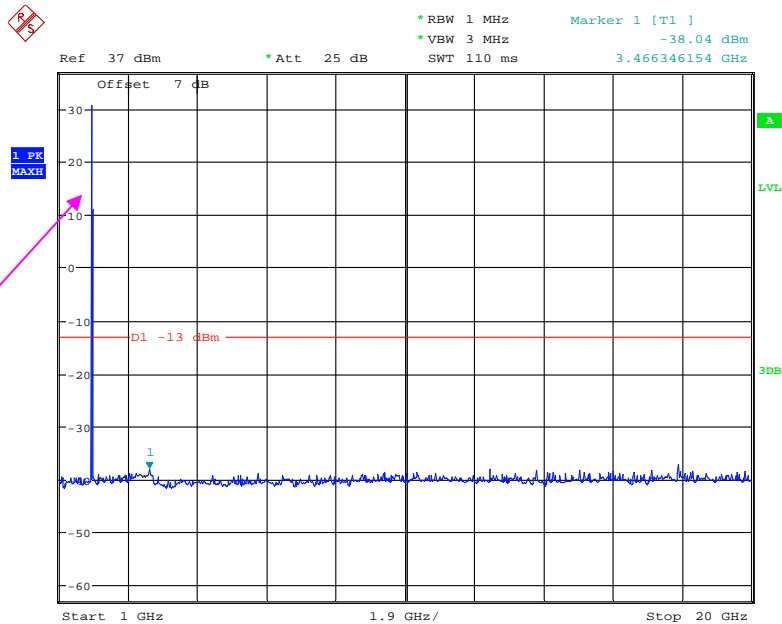
High Channel

30 MHz – 1 GHz (GSM Mode)



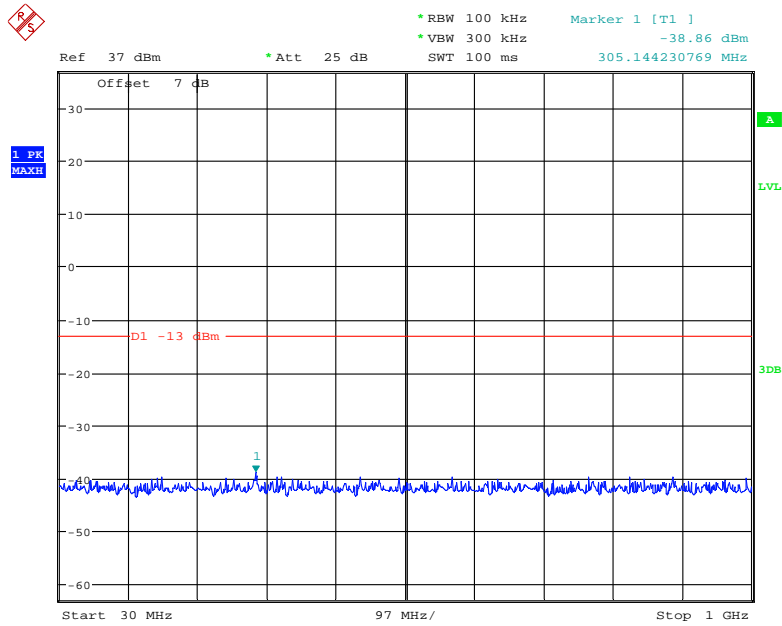
Date: 10.JAN.2021 19:02:11

1 GHz – 20 GHz (GSM Mode)



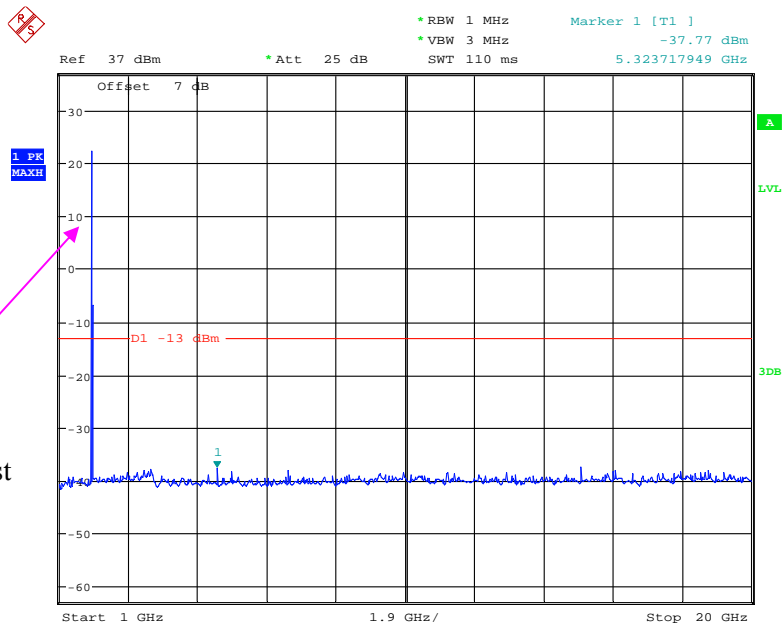
Date: 10.JAN.2021 19:04:21

30 MHz – 1 GHz (WCDMA Mode)



Date: 10.JAN.2021 19:02:20

1 GHz – 20 GHz (WCDMA Mode)



Fundamental test

Date: 10.JAN.2021 19:10:47

FCC § 2.1053; § 22.917 (a);§ 24.238 (a) -SPURIOUS RADIATED EMISSIONS**Applicable Standard**

FCC § 2.1053, §22.917(a) and § 24.238(a).

Test Procedure

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

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

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

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 (TX pwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log₁₀ (power out in Watts)

Test Data**Environmental Conditions**

Temperature:	22.2~23 °C
Relative Humidity:	40~52 %
ATM Pressure:	101.0 kPa

The testing was performed by Holland Yang and Leven Gan on 2021-01-10.

EUT operation mode: Transmitting

30 MHz ~ 10 GHz:

Cellular Band (Part 22H)

Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
GSM Mode, Low channel										
965.3	32.69	43	2.0	H	-63.8	1.36	0.0	-65.16	-13	52.16
965.3	33.81	53	1.4	V	-60.2	1.36	0.0	-61.56	-13	48.56
1648.40	74.42	24	2.1	H	-33.7	1.40	8.70	-26.40	-13	13.40
1648.40	72.35	207	2.4	V	-35.5	1.40	8.70	-28.20	-13	15.20
2472.60	56.14	343	2.2	H	-47.2	2.60	10.20	-39.60	-13	26.60
2472.60	57.29	259	2.4	V	-45.5	2.60	10.20	-37.90	-13	24.90
3296.80	43.89	133	1.4	H	-57.0	1.50	11.70	-46.80	-13	33.80
3296.80	44.65	3	2.3	V	-56.3	1.50	11.70	-46.10	-13	33.10
GSM Mode, Middle channel										
960.6	32.57	61	1.6	H	-63.9	1.36	0.0	-65.26	-13	52.26
960.6	33.69	198	1.7	V	-60.4	1.36	0.0	-61.76	-13	48.76
1673.20	73.67	74	1.8	H	-32.7	1.30	8.90	-25.10	-13	12.10
1673.20	73.05	186	1.8	V	-32.7	1.30	8.90	-25.10	-13	12.10
2509.80	55.25	26	1.5	H	-48.1	2.60	10.20	-40.50	-13	27.50
2509.80	56.88	261	1.2	V	-45.9	2.60	10.20	-38.30	-13	25.30
3346.40	44.14	216	1.1	H	-56.7	1.50	11.70	-46.50	-13	33.50
3346.40	44.85	291	1.4	V	-56.1	1.50	11.70	-45.90	-13	32.90
GSM Mode, High channel										
965.8	32.38	37	2.0	H	-64.1	1.36	0.0	-65.46	-13	52.46
965.8	33.61	329	1.8	V	-60.4	1.36	0.0	-61.76	-13	48.76
1697.60	73.14	212	2.1	H	-33.2	1.30	8.90	-25.60	-13	12.60
1697.60	72.47	1	1.8	V	-33.3	1.30	8.90	-25.70	-13	12.70
2546.40	55.24	227	2.0	H	-48.1	2.60	10.20	-40.50	-13	27.50
2546.40	56.54	142	1.3	V	-46.2	2.60	10.20	-38.60	-13	25.60
3395.20	44.23	305	1.5	H	-57.0	1.40	11.80	-46.60	-13	33.60
3395.20	45.19	268	1.1	V	-55.9	1.40	11.80	-45.50	-13	32.50

Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
WCDMA Mode, Low channel										
961.6	32.56	171	1.9	H	-63.9	1.36	0.0	-65.26	-13	52.26
961.6	33.47	144	1.1	V	-60.6	1.36	0.0	-61.96	-13	48.96
1652.80	48.42	317	2.0	H	-57.9	1.30	8.90	-50.30	-13	37.30
1652.80	49.63	349	1.8	V	-56.1	1.30	8.90	-48.50	-13	35.50
2479.20	45.16	323	1.8	H	-58.2	2.60	10.20	-50.60	-13	37.60
2479.20	45.35	67	1.7	V	-57.4	2.60	10.20	-49.80	-13	36.80
3305.60	44.15	78	2.4	H	-56.7	1.50	11.70	-46.50	-13	33.50
3305.60	43.54	165	1.5	V	-57.4	1.50	11.70	-47.20	-13	34.20
WCDMA Mode, Middle channel										
961.3	32.64	20	1.0	H	-63.9	1.36	0.0	-65.26	-13	52.26
961.3	33.51	255	1.4	V	-60.5	1.36	0.0	-61.86	-13	48.86
1673.20	49.36	318	2.5	H	-57.0	1.30	8.90	-49.40	-13	36.40
1673.20	50.18	284	2.0	V	-55.6	1.30	8.90	-48.00	-13	35.00
2509.80	45.21	24	1.3	H	-58.1	2.60	10.20	-50.50	-13	37.50
2509.80	45.16	74	2.0	V	-57.6	2.60	10.20	-50.00	-13	37.00
3346.40	43.31	145	1.9	H	-57.6	1.50	11.70	-47.40	-13	34.40
3346.40	43.67	146	1.3	V	-57.3	1.50	11.70	-47.10	-13	34.10
WCDMA Mode, High channel										
959.4	32.71	298	1.4	H	-63.8	1.36	0.0	-65.16	-13	52.16
959.4	33.57	213	1.3	V	-60.5	1.36	0.0	-61.86	-13	48.86
1693.20	48.35	98	1.6	H	-58.0	1.30	8.90	-50.40	-13	37.40
1693.20	48.67	183	1.7	V	-57.1	1.30	8.90	-49.50	-13	36.50
2539.80	44.82	273	1.7	H	-58.5	2.60	10.20	-50.90	-13	37.90
2539.80	44.97	283	1.8	V	-57.8	2.60	10.20	-50.20	-13	37.20
3386.40	43.23	138	1.7	H	-58.0	1.40	11.80	-47.60	-13	34.60
3386.40	43.79	66	1.3	V	-57.3	1.40	11.80	-46.90	-13	33.90

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

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
GSM Mode, Low channel										
962.1	32.57	216	1.1	H	-63.9	1.36	0.0	-65.26	-13	52.26
962.1	33.64	226	2.4	V	-60.4	1.36	0.0	-61.76	-13	48.76
3700.40	55.17	43	1.2	H	-46.6	1.60	11.90	-36.30	-13	23.30
3700.40	53.59	13	1.4	V	-47.6	1.60	11.90	-37.30	-13	24.30
GSM Mode, Middle channel										
963.2	32.44	329	2.4	H	-64.1	1.36	0.0	-65.46	-13	52.46
963.2	33.66	97	2.3	V	-60.4	1.36	0.0	-61.76	-13	48.76
3760.00	54.73	89	1.6	H	-47.3	1.50	11.80	-37.00	-13	24.00
3760.00	53.64	74	1.0	V	-47.9	1.50	11.80	-37.60	-13	24.60
GSM Mode, High channel										
962.5	32.49	354	1.2	H	-64.0	1.36	0.0	-65.36	-13	52.36
962.5	33.56	210	1.6	V	-60.5	1.36	0.0	-61.86	-13	48.86
3819.60	54.87	284	1.1	H	-47.2	1.50	11.80	-36.90	-13	23.90
3819.60	53.69	338	1.7	V	-47.9	1.50	11.80	-37.60	-13	24.60
WCDMA Mode, Low channel										
961.2	32.75	326	1.2	H	-63.8	1.36	0.0	-65.16	-13	52.16
961.2	33.61	155	1.1	V	-60.4	1.36	0.0	-61.76	-13	48.76
3704.80	46.56	172	1.5	H	-55.2	1.60	11.90	-44.90	-13	31.90
3704.80	50.20	131	1.1	V	-51.0	1.60	11.90	-40.70	-13	27.70
WCDMA Mode, Middle channel										
956.6	32.66	170	1.1	H	-63.8	1.36	0.0	-65.16	-13	52.16
956.6	33.49	322	2.0	V	-60.6	1.36	0.0	-61.96	-13	48.96
3760.00	46.87	152	1.3	H	-55.2	1.50	11.80	-44.90	-13	31.90
3760.00	49.98	125	1.7	V	-51.6	1.50	11.80	-41.30	-13	28.30
WCDMA Mode, High channel										
964.8	32.52	25	1.1	H	-64.0	1.36	0.0	-65.36	-13	52.36
964.8	33.73	167	2.3	V	-60.3	1.36	0.0	-61.66	-13	48.66
3815.20	47.42	143	1.5	H	-54.6	1.50	11.80	-44.30	-13	31.30
3815.20	50.65	270	1.7	V	-50.9	1.50	11.80	-40.60	-13	27.60

Note:

1) Absolute Level = Substituted Level - Cable loss + Antenna Gain

2) Margin = Limit - Absolute Level

3) The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

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

Applicable Standard

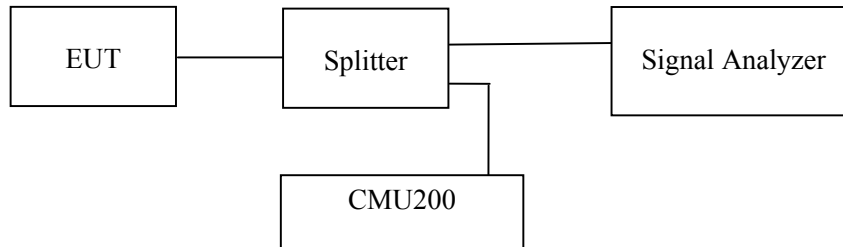
According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

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

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

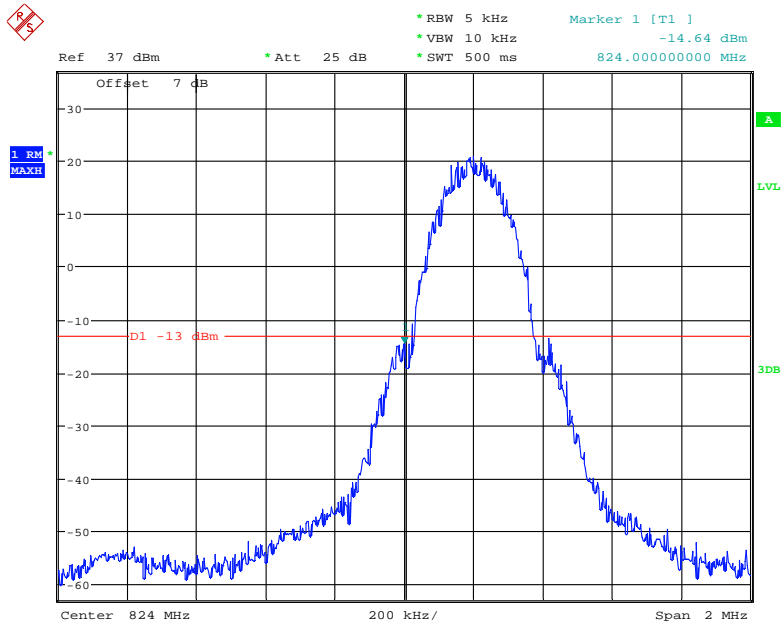
Temperature:	25 °C
Relative Humidity:	55 %
ATM Pressure:	100.0 kPa

The testing was performed by Black Chen on 2021-01-10.

EUT operation mode: Transmitting

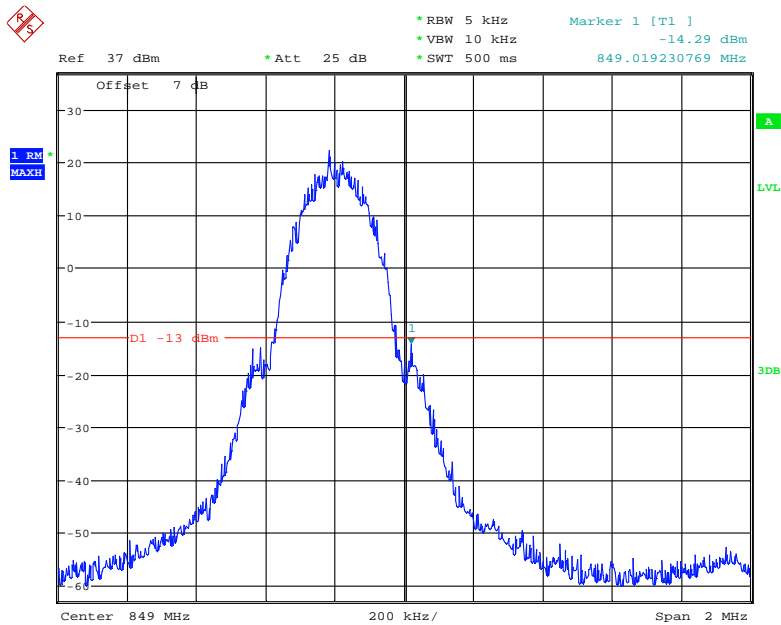
Test Result: Compliance. Please refer to the following plots.

Cellular Band, Left Band Edge for GSM (GMSK) Mode



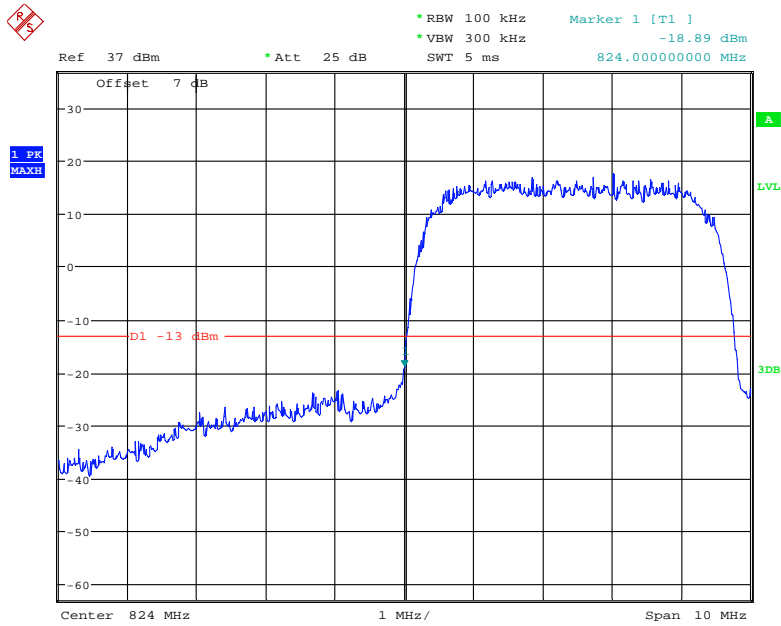
Date: 10.JAN.2021 18:51:29

Cellular Band, Right Band Edge for GSM (GMSK) Mode



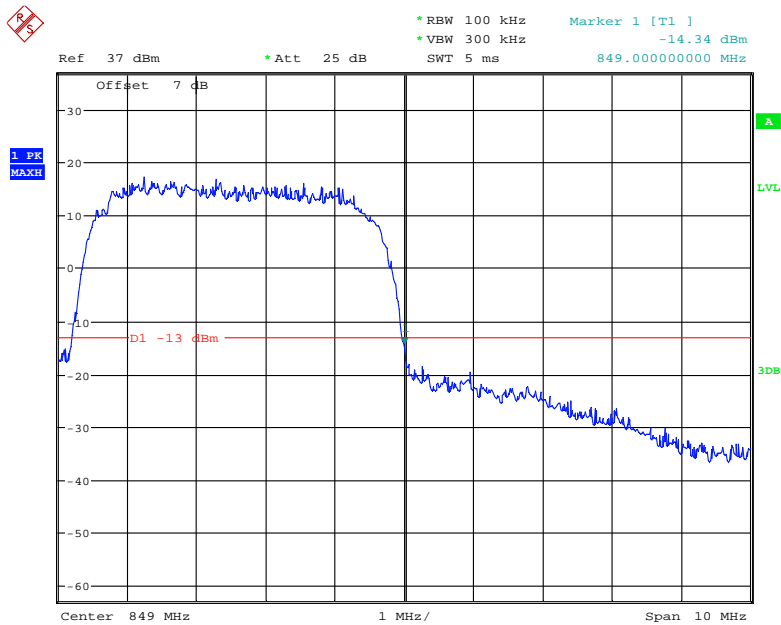
Date: 10.JAN.2021 18:50:33

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



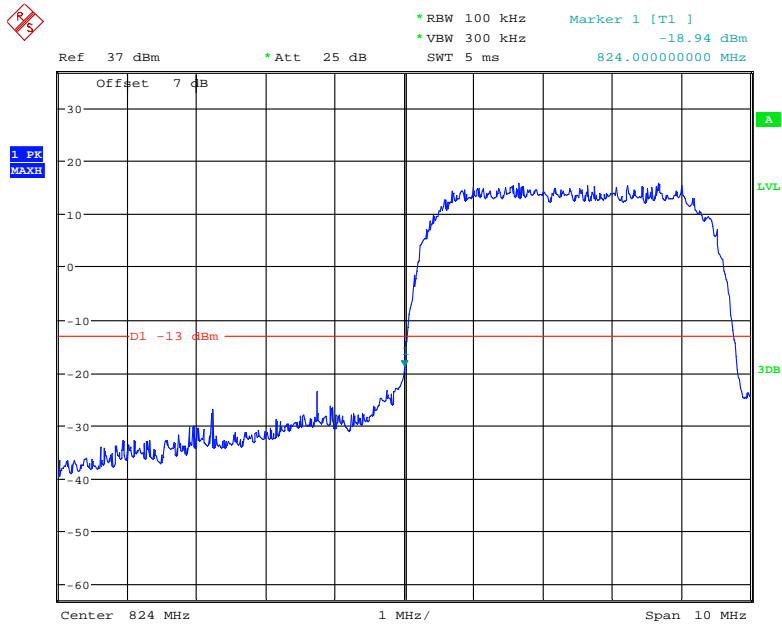
Date: 10.JAN.2021 18:47:19

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



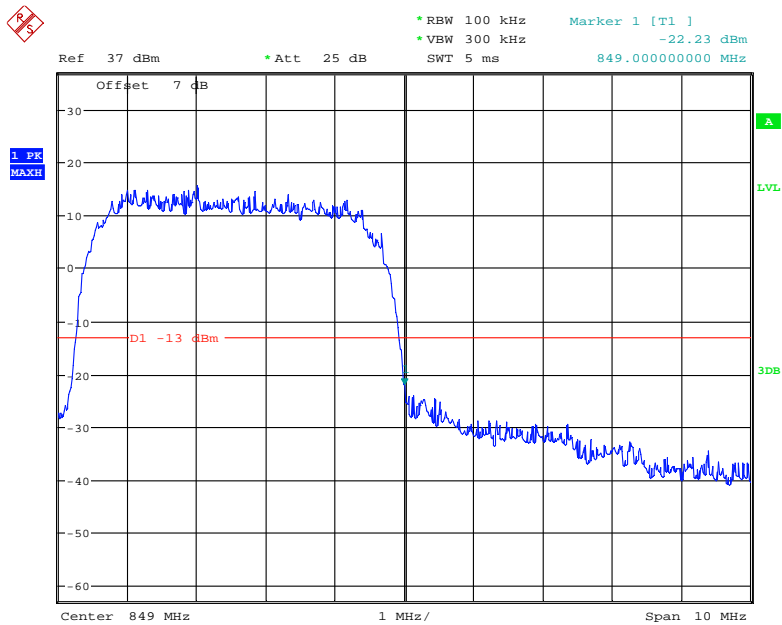
Date: 10.JAN.2021 18:47:45

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



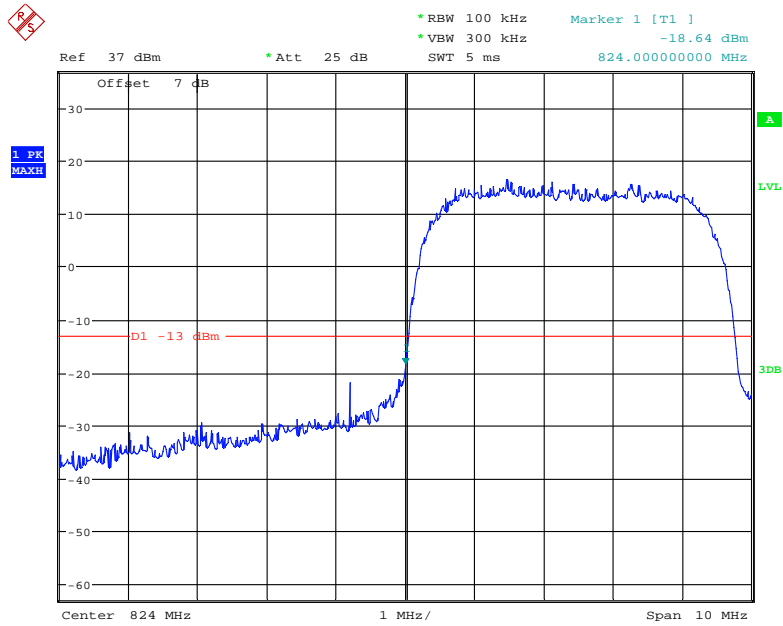
Date: 10.JAN.2021 18:46:30

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



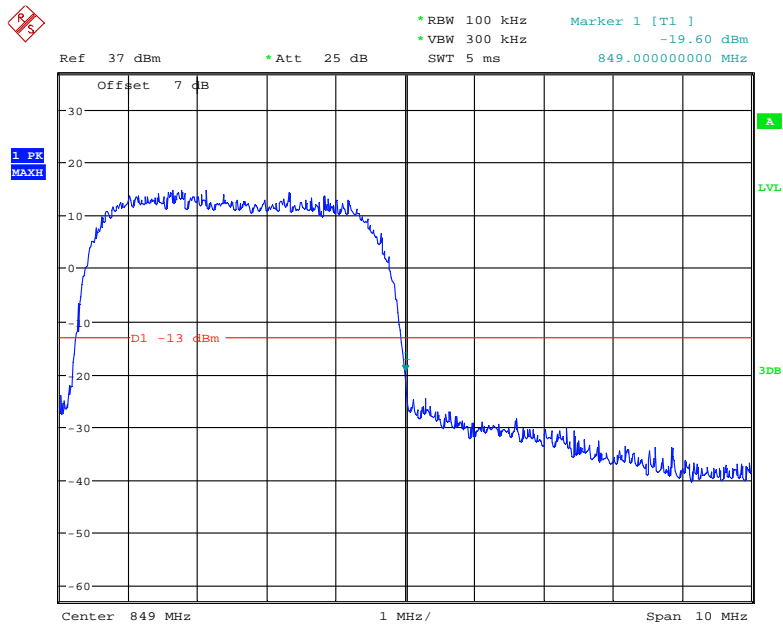
Date: 10.JAN.2021 18:46:12

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



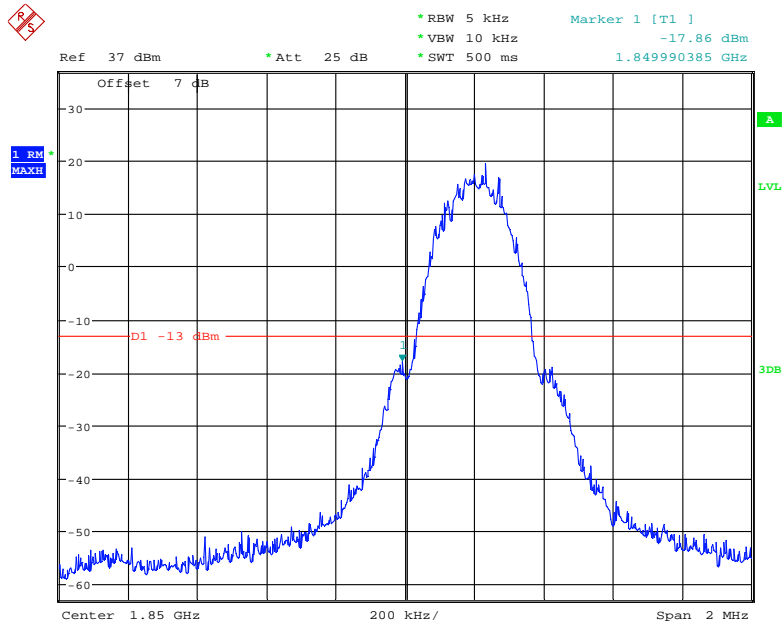
Date: 10.JAN.2021 18:44:39

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



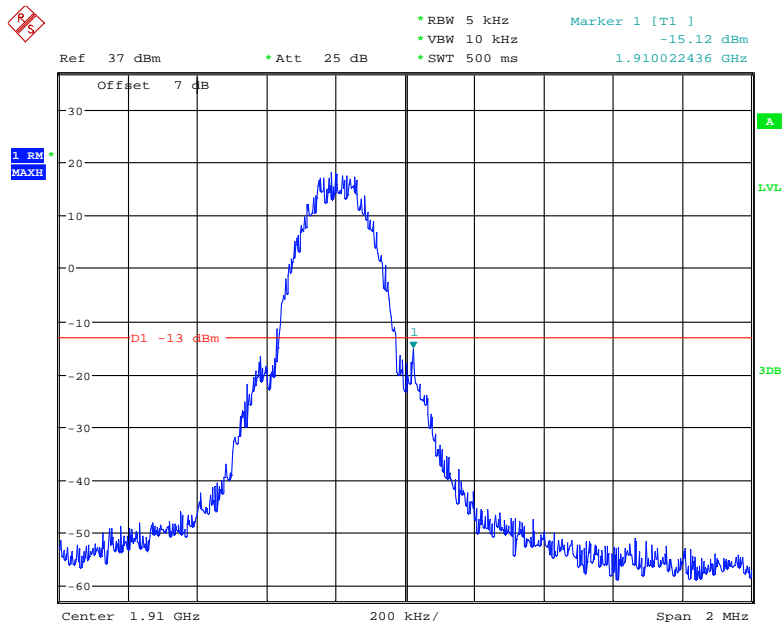
Date: 10.JAN.2021 18:45:02

PCS Band, Left Band Edge for GSM (GMSK) Mode



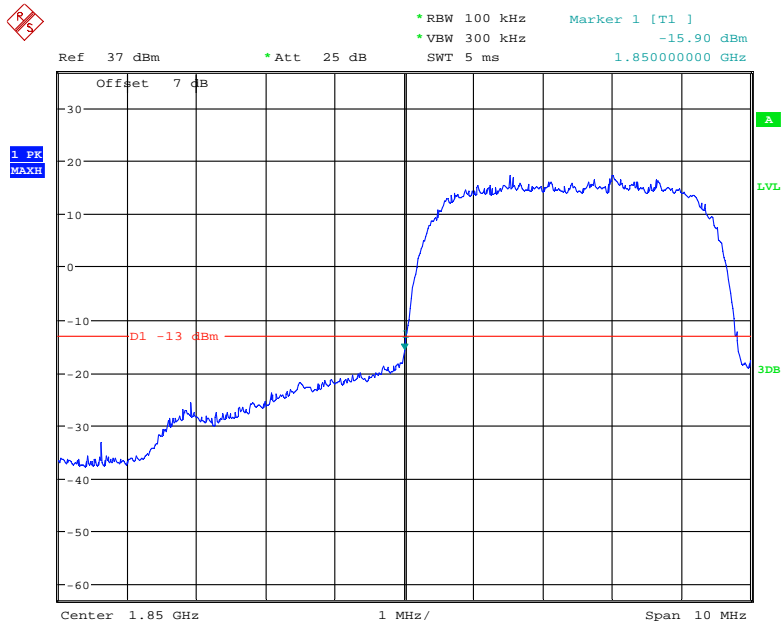
Date: 10.JAN.2021 18:57:25

PCS Band, Right Band Edge for GSM (GMSK) Mode



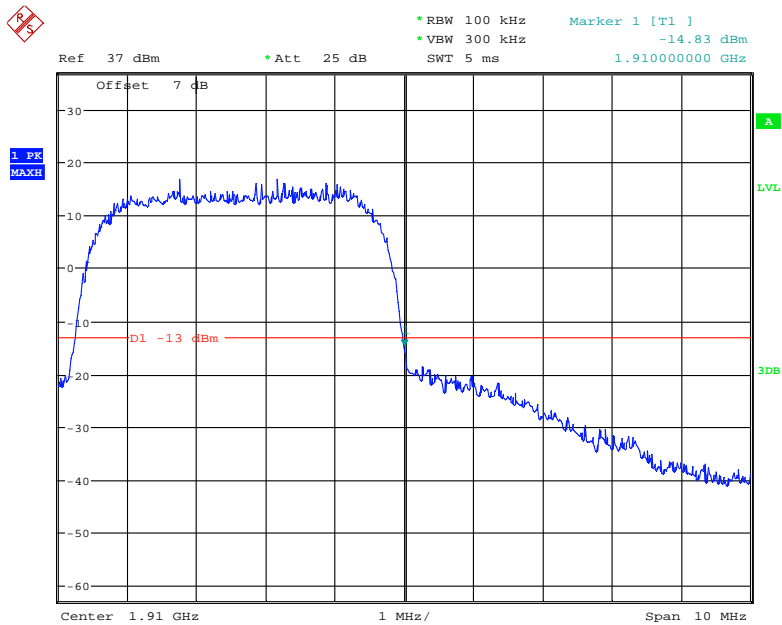
Date: 10.JAN.2021 18:58:01

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



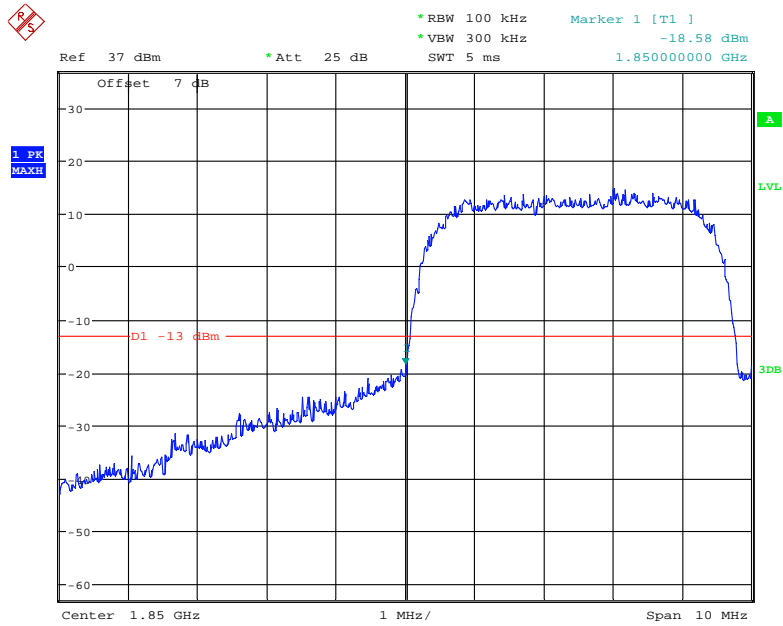
Date: 10.JAN.2021 18:41:38

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



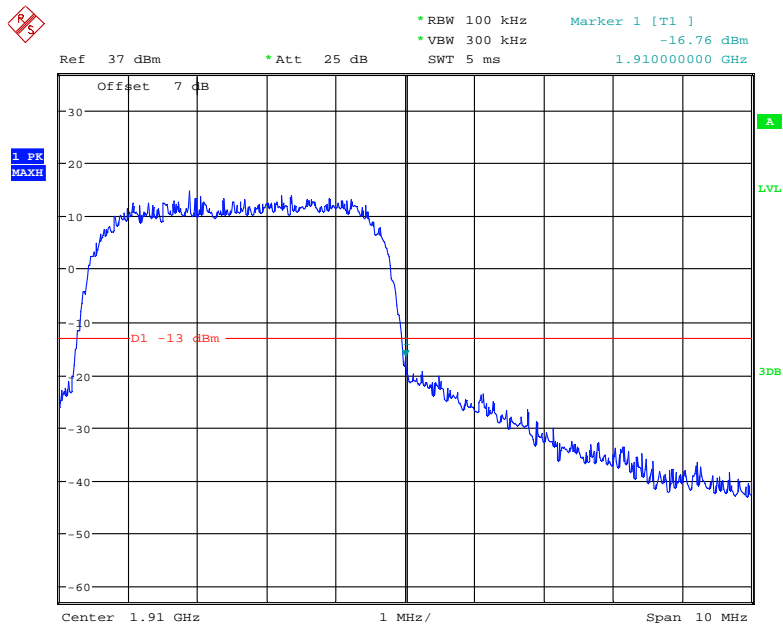
Date: 10.JAN.2021 18:42:30

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



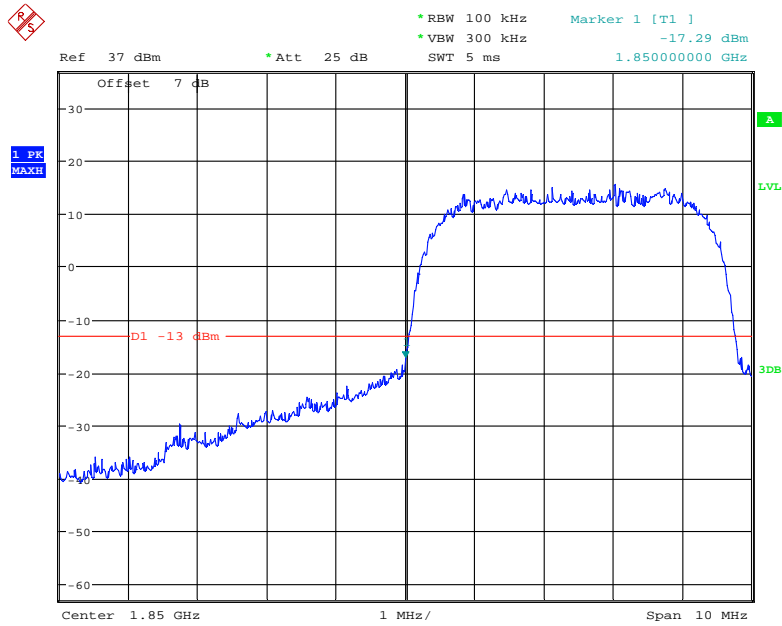
Date: 10.JAN.2021 18:43:09

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



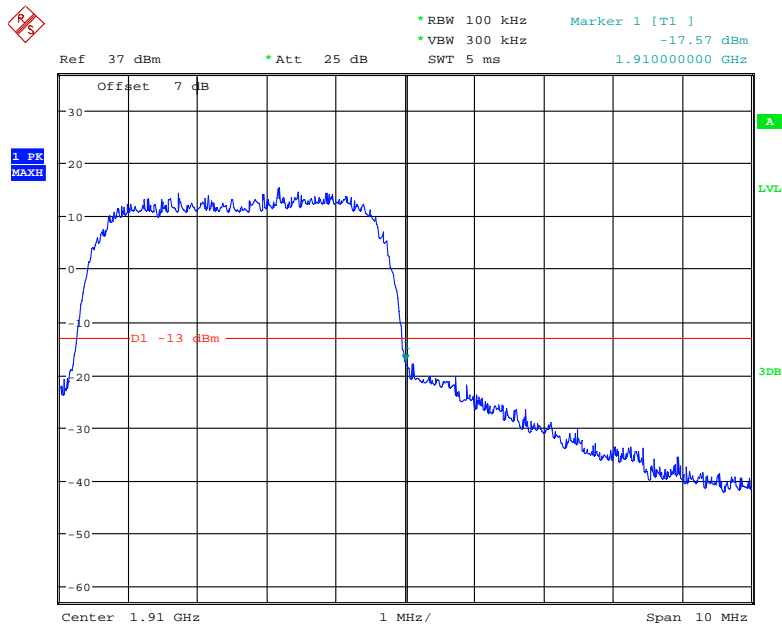
Date: 10.JAN.2021 18:42:53

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



Date: 10.JAN.2021 18:43:43

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



Date: 10.JAN.2021 18:44:03

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

Applicable Standard

FCC § 2.1055, §22.355 and §24.235.

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

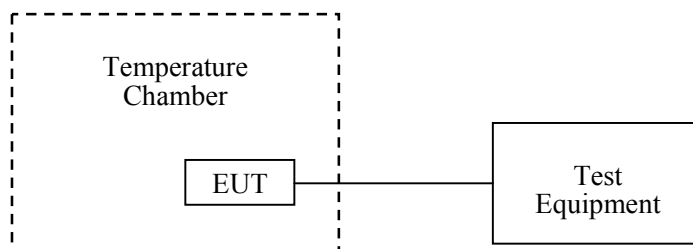
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

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:	25 °C
Relative Humidity:	55 %
ATM Pressure:	100.0 kPa

The testing was performed by Black Chen on 2021-01-08.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to the following tables.

Cellular Band (Part 22H)

GSM Mode

Middle Channel, $f_0 = 836.6\text{MHz}$				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	3.8	28	0.0335	2.5
-20		25	0.0299	2.5
-10		23	0.0275	2.5
0		24	0.0287	2.5
10		22	0.0263	2.5
20		21	0.0251	2.5
30		24	0.0287	2.5
40		23	0.0275	2.5
50		25	0.0299	2.5
20		V min.= 3.35	19	0.0227
20	V max.= 4.35	27	0.0323	2.5

WCDMA Mode

Middle Channel, $f_0 = 836.6\text{MHz}$				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	3.8	6	0.0072	2.5
-20		5	0.0060	2.5
-10		4	0.0048	2.5
0		7	0.0084	2.5
10		5	0.0060	2.5
20		3	0.0036	2.5
30		-5	-0.0060	2.5
40		2	0.0024	2.5
50		-2	-0.0024	2.5
20		V min.= 3.35	5	0.0060
20	V max.= 4.35	7	0.0084	2.5

PCS Band (Part 24E)

GSM Mode

Middle Channel, $f_0 = 1880.0\text{ MHz}$				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Result
-30	3.8	23	0.0122	Pass
-20		21	0.0112	Pass
-10		26	0.0138	Pass
0		25	0.0133	Pass
10		22	0.0117	Pass
20		21	0.0112	Pass
30		19	0.0101	Pass
40		15	0.0080	Pass
50		24	0.0128	Pass
20		V min.= 3.35	23	0.0122
20	V max.= 4.35	21	0.0112	Pass

WCDMA Mode

Middle Channel, f₀ =1880.0 MHz				
Temperature (°C)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Result
-30	3.8	2	0.0011	Pass
-20		-1	-0.0005	Pass
-10		-4	-0.0021	Pass
0		-2	-0.0011	Pass
10		2	0.0011	Pass
20		-1	-0.0005	Pass
30		1	0.0005	Pass
40		-3	-0.0016	Pass
50		-4	-0.0021	Pass
20	V min.= 3.35	-5	-0.0027	Pass
20	V max.= 4.35	4	0.0021	Pass

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