FCC TEST REPORT

Test report

On Behalf of

Shanghai Dewav IoT Technology Co.,Ltd.

For

Real-time temperature logger

Model No.: B9Z(4G-30), B9Z(4G-60), B9Z(4G-120), V5L(4G-30), V5L(4G-60), V5L(4G-120),V5B(4G-60), V5B(4G-90), V5B(4G-120), V5C(4G-60), V5C(4G-90), V5C(4G-120), V5Y(4G-60), V5Y(4G-120), V5J(4G-60), V5J(4G-120), V5B Non -Li(4G-60), V5B Non-Li(4G-120), V5C Non-Li(4G-60), V5C Non-Li(4G-120), V57(4G), V56(4G), V55(4G), V58(4G), V59(4G)

FCC ID: 2ATWZ-V5X4G

Prepared for :	**Shanghai Dewav IoT Technology Co.,Ltd.** 5th Floor,C8-30 of Lane 3188,Xiupu Road,Pudong New District,Shanghai,201315,P.R.China
Prepared By :	**Shenzhen Tongzhou Testing Co.,Ltd** **1th Floor, Building 1, Haomai High-tech Park, Huating Road 387, Dalang Street, Longhua, Shenzhen, China**
Date of Test:	**2021/9/10 - 2021/10/10**
Date of Report:	**2022/6/23**
Report Number:	**TZ220603347-E1**

TEST RESULT CERTIFICATION

Applicant's name ..... :	**Shanghai Dewav IoT Technology Co.,Ltd.**
Address ..... :	5th Floor,C8-30 of Lane 3188,Xiupu Road,Pudong New District,Shanghai,201315,P.R.China
Manufacture's Name ..... :	**Shanghai Dewav IoT Technology Co.,Ltd.**
Address ..... :	5th Floor,C8-30 of Lane 3188,Xiupu Road,Pudong New District,Shanghai,201315,P.R.China

Product description

Trade Mark ..... :	Frigga
Product name ..... :	Real-time temperature logger
Model and/or type reference . :	Refer to Page1
Standards ..... :	FCC Rules and Regulations Part 22 & Part 24 ANSI C63.26:2015

Date of Test ..... :	
Date (s) of performance of tests..... :	**2021/9/10 - 2021/10/10**
Date of Issue ..... :	**2022/6/23**
Test Result..... :	**Pass**

Testing Engineer : Anna Hu

(Anna Hu)

Technical Manager : Hugo Chen

(Hugo Chen)

Authorized Signatory : Andy Zhang

(Andy Zhang)

Revision History

Revision	Issue Date	Revisions	Revised By
000	2022/6/23	Initial Issue	Andy Zhang

Contents

1 TEST STANDARDS

The tests were performed according to following standards:
FCC Part 2: FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS
FCC Part 22 Subpart H: PRIVATE LAND MOBILE RADIO SERVICES.
FCC Part 24 Subpart E: PUBLIC MOBILE SERVICES
ANSI/TIA-603-E-2016: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.
ANSI C63.26-2015: IEEE/ANSI Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
FCCKDB971168D01 Power Meas License Digital Systems

2 SUMMARY

2.1 Product Description

EUT	:	Real-time temperature logger
Model Number	:	Refer to Page1
Model Declaration	:	Refer to section 2.2 of this report
Test Model	:	V5C Non-Li(4G-60)
Power Supply	:	1,DC 3.7V/3.6V by battery 2,DC 5.0V charged by adapter
Hardware version	:	V56MR41B
Software version	:	V5C_4L_L107
Sample ID	:	TZ220603347–1# & TZ220603347–2#
GSM		
GSM FCC Operation Frequency	:	GSM850(UL: 824 – 849 MHz/DL: 869 – 894 MHz) GSM1900(UL: 1850 –1910 MHz/DL: 1930 – 1990 MHz)
Channel Separation	:	0.2MHz
Modulation Technology	:	GMSK, 8PSK
Antenna Type And Gain	:	Internal Antenna GSM850: 0.3 dBi PCS1900: 0.12 dBi
E-UTRA		
E-UTRA FCC Operation Frequency	:	FDD Band 2 (UL: 1850 – 1910 MHz/DL: 1930 – 1990 MHz) FDD Band 4 (UL: 1710 – 1755 MHz/DL: 2110 – 2155 MHz) FDD Band 5 (UL: 824 – 849 MHz/DL: 869 – 894 MHz) FDD Band 7(UL: 2500 MHz - 2570 MHz/DL: 2620 - 2690 MHz) FDD Band 66 (UL: 1710 – 1780 MHz/DL: 2110 – 2180 MHz)
Channel Separation	:	0.1 MHz
Modulation Technology	:	OFDM (16QAM, QPSK)
Antenna Type And Gain	:	Internal Antenna FDD Band 2: -1.01 dBi, FDD Band 4: -0.9 dBi, FDD Band 5: -0.89 dBi, FDD Band 7: 0.28 dBi, FDD Band 66: 0.17 dBi

Note: Antenna position refer to EUT Photos.

GSM Card Slot:

	Maximum ERP/EIRP (dBm)	Max. Conducted Power (dBm)	Max. Average Burst Power (dBm)
GPRS 850	**26.54**	**31.93**	**31.64**
EGPRS 850	**20.65**	**29.63**	**26.74**
GPRS 1900	**24.65**	**30.05**	**29.83**
EGPRS 1900	**19.40**	**29.01**	**25.47**

2.2 Difference of Models

The difference shows in following table, other design are identical.

Derived Model	Difference		Appearance
	Function	Battery	
B9Z(4G-30) **B9Z(4G-60)** **B9Z(4G-120)**	without external probe without LCD	Li-ion battery Nominal voltage: 3.7Vdc	
V5L(4G-30) **V5L(4G-60)** **V5L(4G-120)**	without external probe without LCD	Li-ion battery Nominal voltage: 3.7Vdc	
V5B(4G-60) **V5B(4G-90)** **V5B(4G-120)**	without external probe with LCD	Li-ion battery Nominal voltage: 3.7Vdc	
V5C(4G-60) **V5C(4G-90)** **V5C(4G-120)**	without external probe with LCD	Li-ion battery Nominal voltage: 3.7Vdc	
V56(4G) **V57(4G)**	without external probe with LCD	Li-ion battery Nominal voltage: 3.7Vdc	

Derived Model	Difference		Appearance
	Function	Battery	
V5B Non-Li(4G-60) **V5B Non-Li(4G-120)**	without external probe with LCD	NI-MH battery Nominal voltage: 3.6Vdc	
V5C Non-Li(4G-60) **V5C Non-Li(4G-120)**	without external probe with LCD	NI-MH battery Nominal voltage: 3.6Vdc	
V59(4G)	without external probe with LCD	NI-MH battery Nominal voltage: 3.6Vdc	
V5J(4G-60) **V5J(4G-120)**	with external probe with LCD	Li-ion battery Nominal voltage: 3.7Vdc	
V5Y(4G-60) **V5Y(4G-120)**	with external probe with LCD	Li-ion battery Nominal voltage: 3.7Vdc	
V55(4G)	with external probe with LCD	NI-MH battery Nominal voltage: 3.6Vdc	
V58(4G)	with external probe with LCD	NI-MH battery Nominal voltage: 3.6Vdc	

2.3 Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate

2.4 Short description of the Equipment under Test (EUT)

2.4.1 General Description

EUT is subscriber equipment in the LTE/GSM system. Frequency bands Shows in section 2.1.

2.5 Normal Accessory setting

Fully charged battery was used during the test.

2.6 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

●- supplied by the manufacturer
○ - supplied by the lab

●			

2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2ATWZ-V5X4G** filing to comply with FCC Part 22 and FCC Part 24 Rules.

2.8 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Test Facility

FCC
Designation Number: CN1275
Test Firm Registration Number: 167722
Shenzhen Tongzhou Testing Co.,Ltd has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA
Certificate Number: 5463.01
Shenzhen Tongzhou Testing Co.,Ltd has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

IC
ISED#: 22033
CAB identifier: CN0099
Shenzhen Tongzhou Testing Co.,Ltd has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010

3.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.3 Test Description

PCS 1900:

Test Item	FCC Rule No.	Requirements	Judgement	Sample ID
Effective (Isotropic) Radiated Power	2.1046, 24.232(c)	EIRP ≤ 2W(33dBm)	Pass	TZ220603347-2#
Bandwidth	2.1049 24.238(a)	OBW: No limit. EBW: No limit.	Pass	TZ220603347-1#
Band Edges	2.1051, 24.238(a)	-13dBm	Pass	TZ220603347-1#
Spurious Emission at Antenna Terminals	2.1051, 24.238(a)	-13dBm	Pass	TZ220603347-1#
Field Strength of Spurious Radiation	2.1053, 24.238(a)	-13dBm	Pass	TZ220603347-2#
Frequency Stability	2.1055, 24.235	the fundamental emission stays within the authorized frequency block.	Pass	TZ220603347-1#
Peak to average ratio	24.232(d)	<13dB	Pass	TZ220603347-1#

GSM850:

Test Item	FCC Rule No.	Requirements	Judgement	Sample ID
Effective (Isotropic) Radiated Power	2.1046, 22.913(a)	ERP ≤ 7W(38.5dBm)	Pass	TZ220603347-2#
Occupied Bandwidth	2.1049	OBW: No limit.	Pass	TZ220603347-1#
Emission Bandwidth	22.917(b)	EBW: No limit.	Pass	TZ220603347-1#
Band Edges Compliance	2.1051, 22.917(a)(b)	-13dBm	Pass	TZ220603347-1#
Spurious Emission at Antenna Terminals	2.1051, 22.917	-13dBm	Pass	TZ220603347-1#
Field Strength of Spurious Radiation	2.1053, 22.917	-13dBm	Pass	TZ220603347-2#
Frequency Stability	2.1055, 22.355	the fundamental emissions stay within the authorized bands of operation. (2.5ppm)	Pass	TZ220603347-1#
Peak to average ratio	2.1046, 2.913(a)	<13dB	Pass	TZ220603347-1#

3.4 Equipment Used during the Test

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	MXA Signal Analyzer	Keysight	N9020A	MY52091623	2021/1/4	2022/1/3
2	Power Sensor	Agilent	U2021XA	MY5365004	2021/1/4	2022/1/3
3	Power Meter	Agilent	U2531A	TW53323507	2021/1/4	2022/1/3
4	Loop Antenna	schwarzbeck	FMZB1519B	00023	2019/11/16	2022/11/15
5	Wideband Antenna	schwarzbeck	VULB 9163	958	2019/11/16	2022/11/15
6	Horn Antenna	schwarzbeck	9120D-1141	1574	2019/11/16	2022/11/15
7	EMI Test Receiver	R&S	ESCI	100849/003	2021/1/4	2022/1/3
8	Controller	MF	MF7802	N/A	N/A	N/A
9	Amplifier	schwarzbeck	BBV 9743	209	2021/1/4	2022/1/3
10	Amplifier	Tonscend	TSAMP-0518SE	--	2021/1/4	2022/1/3
11	RF Cable(below 1GHz)	HUBER+SUHNER	RG214	N/A	2021/1/4	2022/1/3
12	RF Cable(above 1GHz)	HUBER+SUHNER	RG214	N/A	2021/1/4	2022/1/3
12	RE test software	Tonscend	JS32-RE	V2.0.2.0	N/A	N/A
14	Test Software	Tonscend	JS1120-3	V2.5.77.0418	N/A	N/A
15	Horn Antenna	A-INFO	LB-180400-KF	J211020657	2020/10/12	2022/10/11
16	Amplifier	CDSA	PAP-1840	17021	2020/10/10	2021/10/09
17	Spectrum Analyzer	R&S	FSP40	100550	2021/1/10	2022/1/9
18	UNIVERSAL RADIO COMMUNICATION	R&S	CMW500	101855	2021/1/4	2022/1/3
19	Signal Generator	Keysight	N5182A	MY4620709	2021/1/4	2022/1/3

3.5 Measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to ETSI TR 100 028 " Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics" and is documented in the Shenzhen Tongzhou Testing Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Tongzhou Testing Co.,Ltd is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	3.10 dB	(1)
Radiated Emission	1~18GHz	3.70 dB	(1)
Radiated Emission	18-40GHz	3.90 dB	(1)
Conducted Disturbance	0.15~30MHz	1.63 dB	(1)
Conducted Power	9KHz~18GHz	0.61 dB	(1)
Spurious RF Conducted Emission	9KHz~40GHz	1.22 dB	(1)
Band Edge Compliance of RF Emission	9KHz~40GHz	1.22 dB	(1)
Occupied Bandwidth	9KHz~40GHz	-	(1)
Frequency Error	9KHz~40GHz	1×10^{-7}	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4 DESCRIPTION OF TEST MODES

During the testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication Tester (CMW 500)to ensure max power transmission and proper modulation. Three channels (The top channel, the middle channel and the bottom channel) were chosen for testing on both GSM and PCS frequency band.

*****Note:** GSM 850, GSM 1900 mode have been tested during the test.

The worst condition was recorded in the test report if no other modes test data.

5 TEST CONDITIONS AND RESULTS

5.1 OUTPUT POWER

5.1.1 CONDUCTED OUTPUT POWER

5.1.1.1 MEASUREMENT METHOD

The transmitter output port was connected to base station.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Measure the maximum burst average power and average power for other modulation signal.

The EUT was setup for the max output power with pseudo random data modulation. Power was measured with Spectrum Analyzer. The measurements were performed on all modes(GSM 850, GSM 1900,)at 3 typical channels(the Top Channel, the Middle Channel and the Bottom Channel) for each band.

5.1.1.2 MEASUREMENT RESULT

Temperature	23.9℃	Humidity	56%
Test Engineer	Anna Hu		

Pass

Mode	Frequency (MHz)	Peak Power	Avg.Burst Power	Duty cycle Factor(dB)	Frame Power (dBm)	Peak to Average Ratio
GPRS850 (1 Slot)	824.2	**31.93**	**31.64**	-9	22.64	**0.28**
	836.6	31.75	31.48	-9	22.48	0.27
	848.8	31.80	31.61	-9	22.61	0.18
GPRS850 (2 Slot)	824.2	30.28	30.08	-6	24.08	0.21
	836.6	30.42	30.27	-6	24.27	0.15
	848.8	30.75	30.49	-6	24.49	0.26
GPRS850 (3 Slot)	824.2	29.66	29.50	-4.26	**25.24**	0.16
	836.6	29.45	29.32	-4.26	25.06	0.13
	848.8	29.24	29.08	-4.26	24.82	0.17
GPRS850 (4 Slot)	824.2	27.61	27.36	-3	24.36	0.24
	836.6	27.35	27.11	-3	24.11	0.24
	848.8	27.41	27.15	-3	24.15	0.25
EGPRS850 (1 Slot)	824.2	**29.63**	**26.74**	-9	17.74	2.90
	836.6	29.20	26.54	-9	17.54	2.65
	848.8	29.33	26.60	-9	17.60	2.72
EGPRS850 (2 Slot)	824.2	27.87	25.47	-6	19.47	2.39
	836.6	28.19	25.25	-6	19.25	**2.94**
	848.8	27.65	25.35	-6	19.35	2.30
EGPRS850 (3 Slot)	824.2	25.25	23.11	-4.26	18.85	2.13
	836.6	25.66	23.47	-4.26	19.21	2.19
	848.8	25.66	23.24	-4.26	18.98	2.42
EGPRS850 (4 Slot)	824.2	24.29	21.93	-3	18.93	2.37
	836.6	23.93	21.59	-3	18.59	2.35
	848.8	24.76	21.83	-3	18.83	2.92

Mode	Frequency (MHz)	Peak Power	Avg.Burst Power	Duty cycle Factor(dB)	Frame Power(dBm)	Peak to Average Ratio
GPRS1900 (1 Slot)	1850.2	29.84	29.66	-9	20.66	0.17
	1880	29.94	29.67	-9	20.67	**0.27**
	1909.8	**30.05**	**29.83**	-9	20.83	0.23
GPRS1900 (2 Slot)	1850.2	27.88	27.61	-6	21.61	0.27
	1880	27.94	27.80	-6	21.80	0.14
	1909.8	27.96	27.80	-6	21.80	0.16
GPRS1900 (3 Slot)	1850.2	27.18	26.91	-4.26	22.65	0.26
	1880	27.03	26.85	-4.26	22.59	0.18
	1909.8	26.76	26.52	-4.26	22.26	0.24
GPRS1900 (4 Slot)	1850.2	25.73	25.62	-3	22.62	0.11
	1880	25.94	25.71	-3	22.71	0.23
	1909.8	25.80	25.67	-3	22.67	0.13
EGPRS1900 (1 Slot)	1850.2	28.80	25.25	-9	16.25	3.55
	1880	28.50	25.15	-9	16.15	3.35
	1909.8	**29.01**	**25.47**	-9	16.47	3.53
EGPRS1900 (2 Slot)	1850.2	28.13	24.97	-6	18.97	3.16
	1880	28.31	24.66	-6	18.66	3.65
	1909.8	28.38	24.96	-6	18.96	3.43
EGPRS1900 (3 Slot)	1850.2	26.21	22.83	-4.26	18.57	3.38
	1880	26.11	22.81	-4.26	18.55	3.30
	1909.8	26.22	22.56	-4.26	18.30	3.66
EGPRS1900 (4 Slot)	1850.2	25.81	21.93	-3	18.93	3.88
	1880	25.70	21.91	-3	18.91	3.79
	1909.8	25.75	21.79	-3	18.79	**3.96**

5.1.2 RADIATED OUTPUT POWER

5.1.2.1 MEASUREMENT METHOD

The measurements procedures specified in ANSI/TIA-603-E-2016 were applied.

1. Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signal operating below 1GHz are performed using dipole antennas. Measurements on signals operating above 1GHz are performed using broadband horn antennas. All measurements are performed as RMS average measurements while the EUT operating at its maximum duty cycle, at maximum power, and at the approximate frequencies.
2. In an anechoic antenna test chamber, a half-wave dipole antenna for the frequency band of interest is placed at the reference centre of the chamber. An RF Signal source for the frequency band of interest is connected to the dipole with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A known (measured) power (Pin) is applied to the input of the dipole, and the power received (Pr) at the chamber's probe antenna is recorded.
3. The substitution method is used. Substitution values at each frequency are measured before and saved to the test software. A "reference path loss" is established as ARpl=Pin + 2.15 - Pr. TheARpl is the attenuation of “reference path loss”, and including the gain of receive antenna, the cable loss and the air loss. The measurement results are obtained as described below: Power=PMea+ARpl
4. The EUT is substituted for the dipole at the reference centre of the chamber and a scan is performed to obtain the radiation pattern.
5. From the radiation pattern, the co-ordinates where the maximum antenna gain occurs are identified.
6. The EUT is then put into continuously transmitting mode at its maximum power level.
7. Power mode measurements are performed with the receiving antenna placed at the coordinates determined in Step 3 to determine the output power as defined in Rule 24.232 (b) and (c). The "reference path loss" from Step1 is added to this result.
8. This value is EIRP since the measurement is calibrated using a half-wave dipole antenna of known gain (2.15 dBi) and known input power (Pin).
9. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi...

5.1.2.2 PROVISIONS APPLICABLE

Mode	FCC Part Section(s)	Nominal Peak Power
GSM 850	22.913(a)(2)	<=38.45dBm (7W). ERP
GSM 1900	24.232(c)	<=33dBm (2W). EIRP

5.1.2.3 Measurement Result

Temperature	24.8℃	Humidity	58%
Test Engineer	Anna Hu		

Radiated Power (ERP) for GPRS/EGPRS 850				
Mode	**Frequency**	**Result**		**Conclusion**
		Max. Peak ERP (dBm)	**Polarization Of Max. E.R.P**	
GPRS	824.2	**26.54**	Horizontal	Pass
	836.6	26.01	Horizontal	Pass
	848.8	24.81	Horizontal	Pass
	824.2	21.10	Vertical	Pass
	836.6	20.98	Vertical	Pass
	848.8	19.92	Vertical	Pass
EGPRS	824.2	**20.65**	Horizontal	Pass
	836.6	19.90	Horizontal	Pass
	848.8	20.61	Horizontal	Pass
	824.2	15.84	Vertical	Pass
	836.6	15.61	Vertical	Pass
	848.8	15.68	Vertical	Pass

Radiated Power (E.I.R.P) for GPRS/EGPRS 1900				
Mode	**Frequency**	**Result**		**Conclusion**
		Max. Peak ERP (dBm)	**Polarization Of Max. E.I.R.P**	
GPRS	1850.2	23.75	Horizontal	Pass
	1880.0	**24.65**	Horizontal	Pass
	1909.8	22.90	Horizontal	Pass
	1850.2	20.66	Vertical	Pass
	1880.0	21.56	Vertical	Pass
	1909.8	21.13	Vertical	Pass
EGPRS	1850.2	**19.40**	Horizontal	Pass
	1880.0	19.14	Horizontal	Pass
	1909.8	18.49	Horizontal	Pass
	1850.2	14.46	Vertical	Pass
	1880.0	14.27	Vertical	Pass
	1909.8	14.36	Vertical	Pass

Note: Above is the worst mode data.

5.2 PEAK-TO-AVERAGE RATIO

5.2.1 MEASUREMENT METHOD

Use one of the procedures presented in 4.1 to measure the total peak power and record as PPk. Use one of the applicable procedures presented 4.2 to measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

PAPR (dB) = PPk (dBm) - PAvg (dBm).

5.2.2 PROVISIONS APPLICABLE

This is the test for the Peak-to-Average Ratio from the EUT.

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

5.2.3 MEASUREMENT RESULT

Modes	Max Peak to Average Ratio(dB)	Upper limit(dB)	Result
GPRS 850	0.28	13	Pass
EGPRS 850	2.94	13	Pass
GPRS 1900	0.27	13	Pass
EGPRS 1900	3.96	13	Pass
Note: refer to section of 5.1.1.2.			

5.3 OCCUPIED BANDWIDTH

5.3.1 MEASUREMENT METHOD

1. The Occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper Frequency limits, the mean power radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

2. RBW=1~5% of the expected OBW, VBW>=3 x RBW, Detector=Peak, Trace mode=max hold, Sweep=auto couple, and the trace was allowed to stabilize.

5.3.2 PROVISIONS APPLICABLE

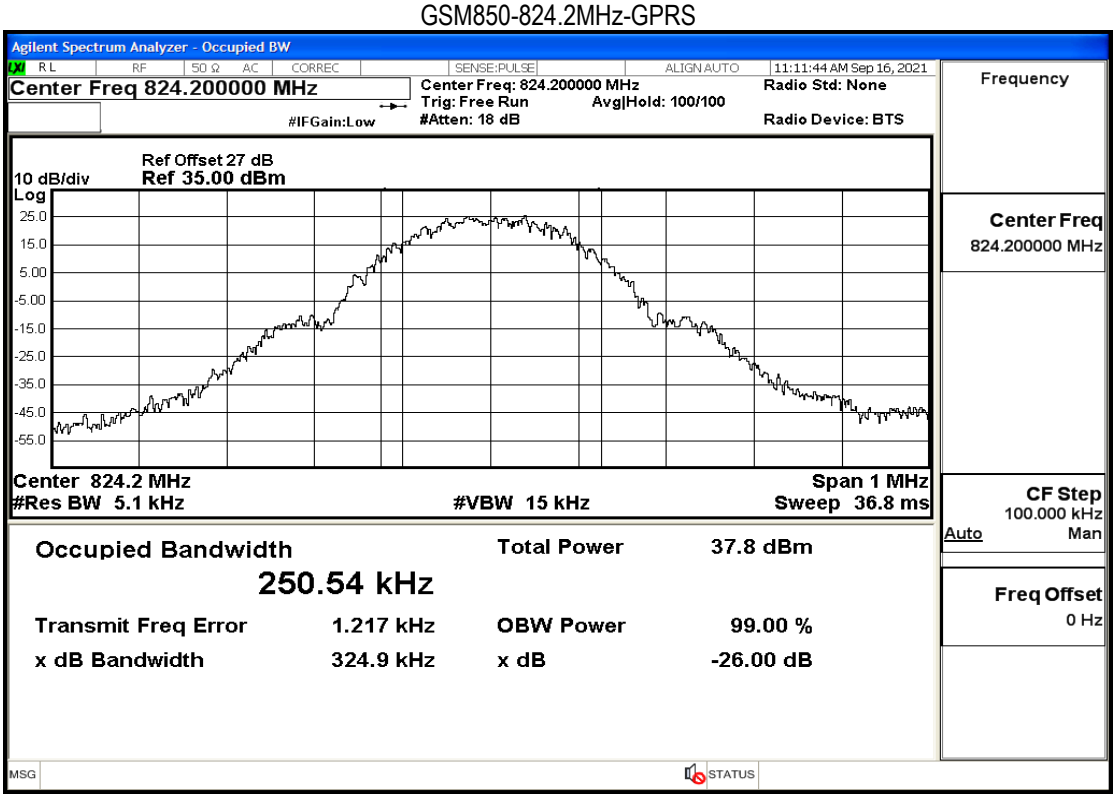
The emission bandwidth is defined as two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26dB below the transmitter power

5.3.3 MEASUREMENT RESULT

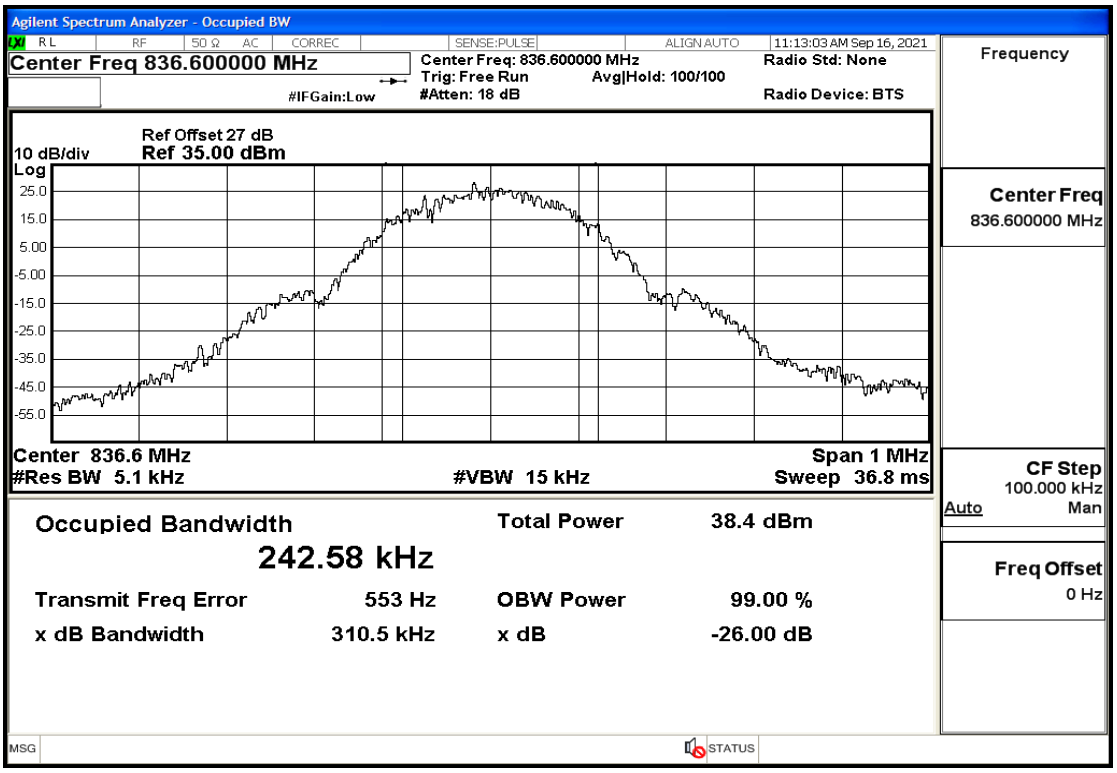
Temperature	23.9℃	Humidity	56%
Test Engineer	Anna Hu		

Type	Frequency(MHz)	Mode	Occupied Bandwidth(KHz)	Emission Bandwidth(KHz)	Limit
GSM850	824.2	GPRS	250.54	324.9	No limit
GSM850	836.6	GPRS	242.58	310.5	No limit
GSM850	848.8	GPRS	248.21	309.9	No limit
GSM850	824.2	EGPRS	234.74	305	No limit
GSM850	836.6	EGPRS	244.63	286.5	No limit
GSM850	848.8	EGPRS	237.66	290.8	No limit
GSM1900	1850.2	GPRS	243.01	311.2	No limit
GSM1900	1880	GPRS	246.74	304.9	No limit
GSM1900	1909.8	GPRS	247.7	306.5	No limit
GSM1900	1850.2	EGPRS	242.56	303.8	No limit
GSM1900	1880	EGPRS	248.49	307.2	No limit
GSM1900	1909.8	EGPRS	234.9	306.2	No limit

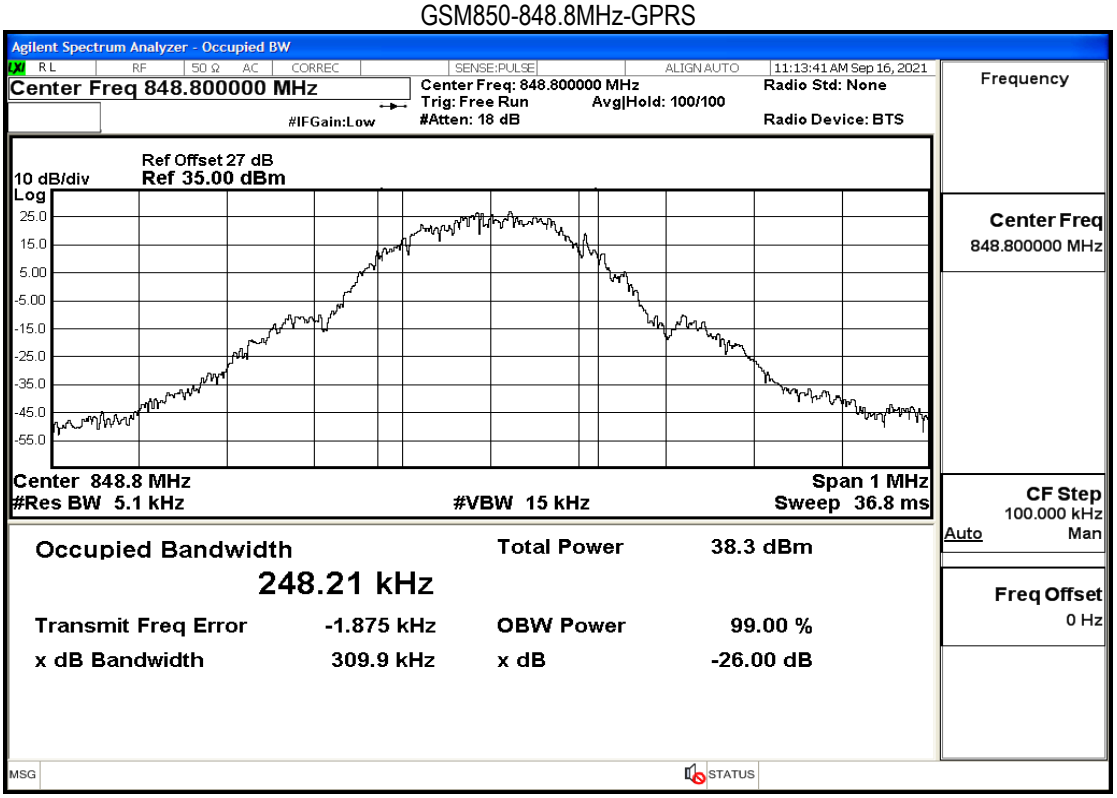
GSM850-824.2MHz-GPRS



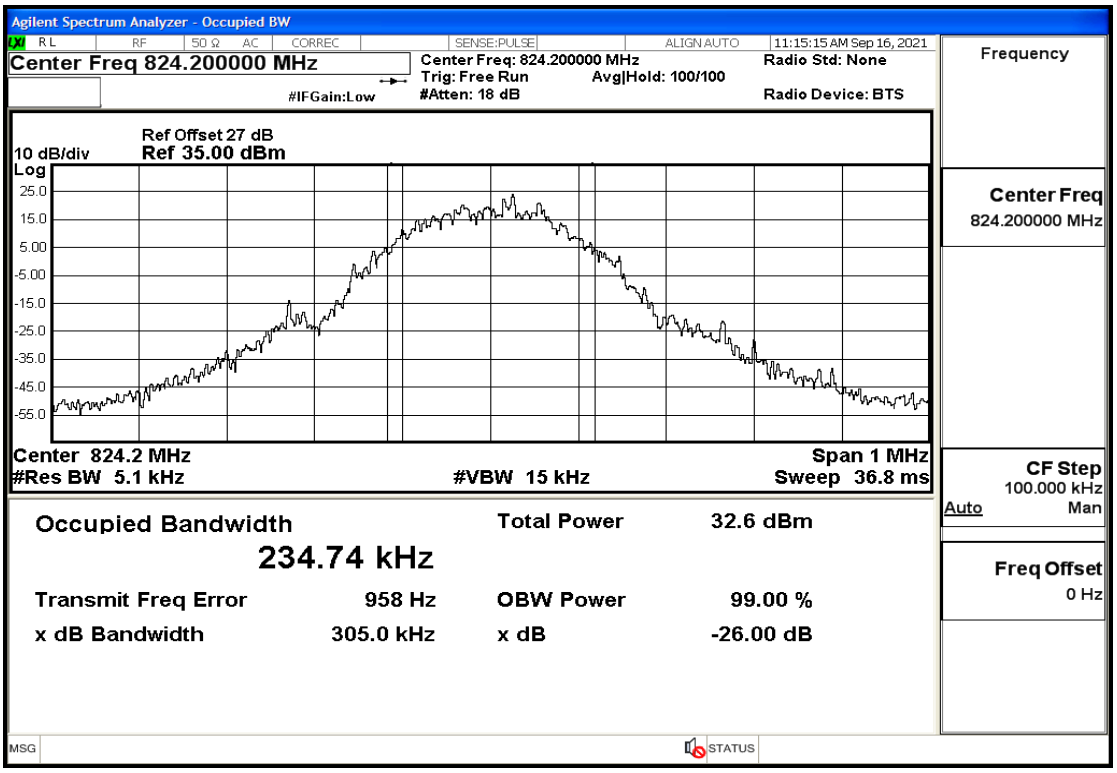
GSM850-836.6MHz-GPRS



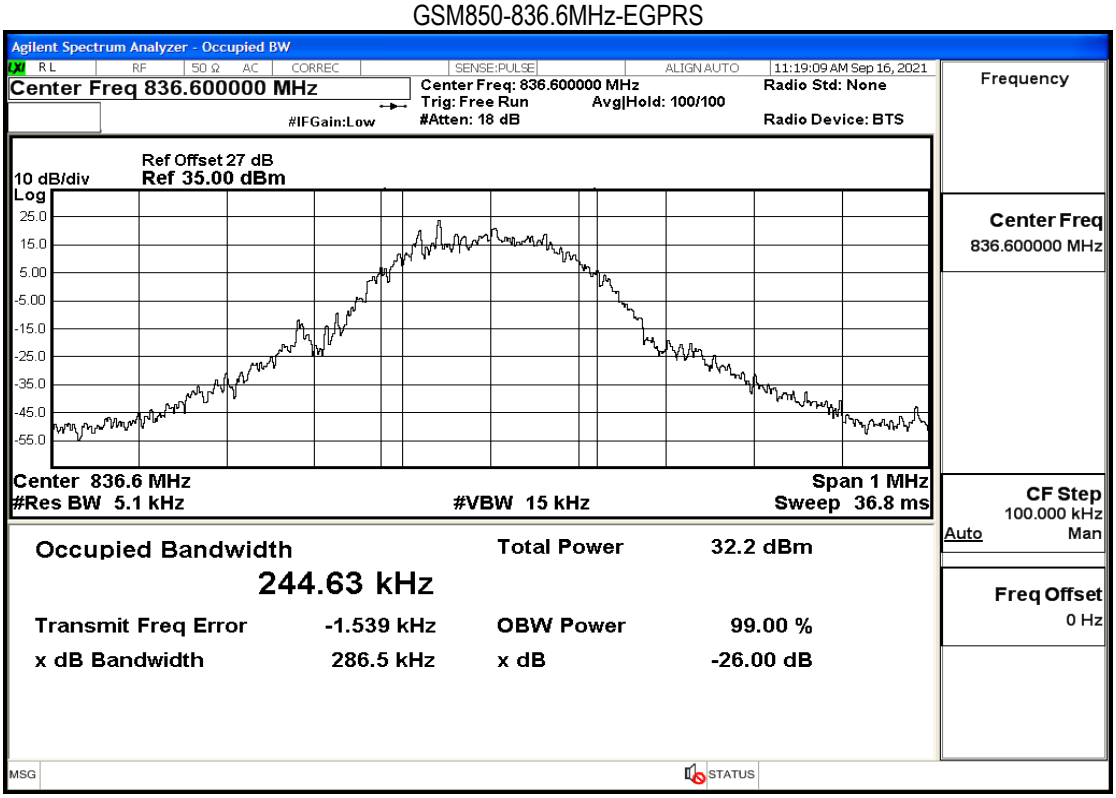
GSM850-848.8MHz-GPRS



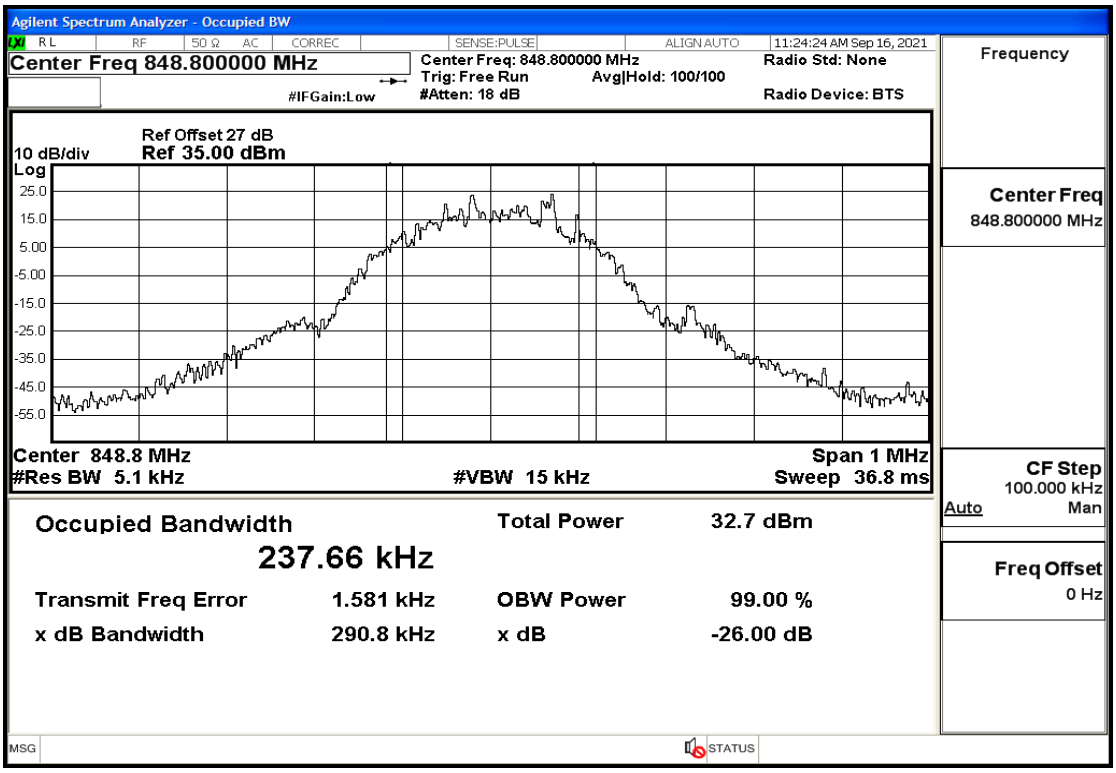
GSM850-824.2MHz-EGPRS



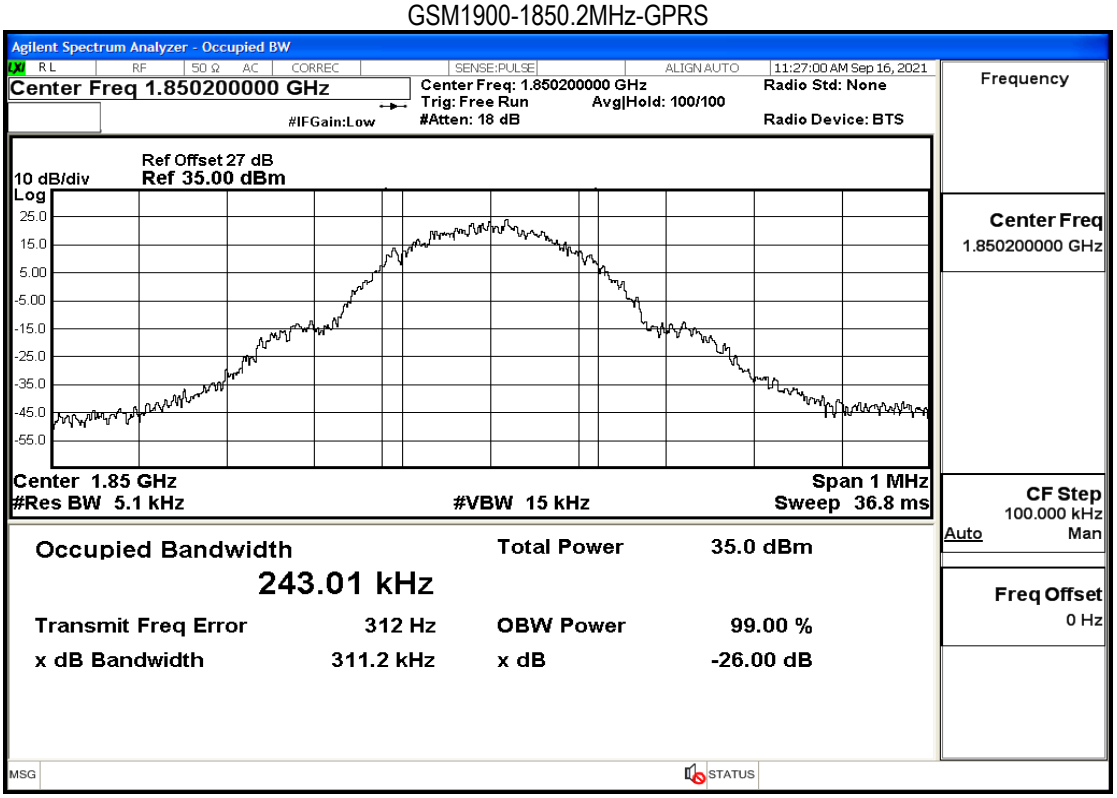
GSM850-836.6MHz-EGPRS



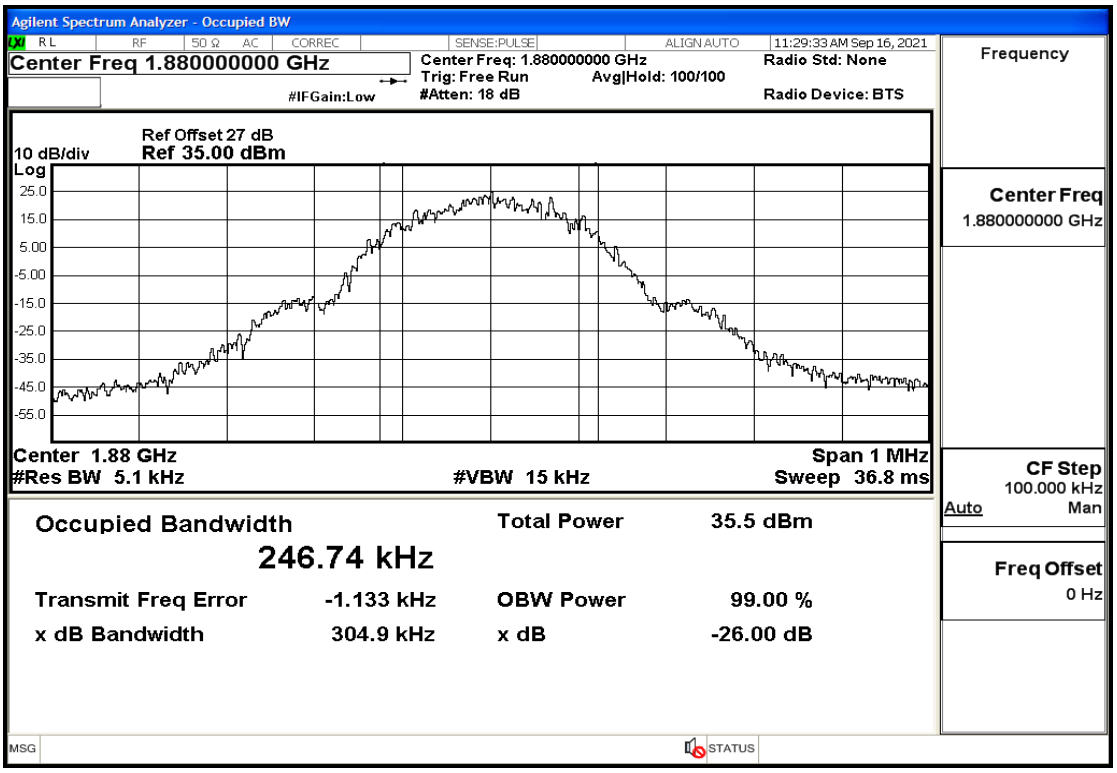
GSM850-848.8MHz-EGPRS



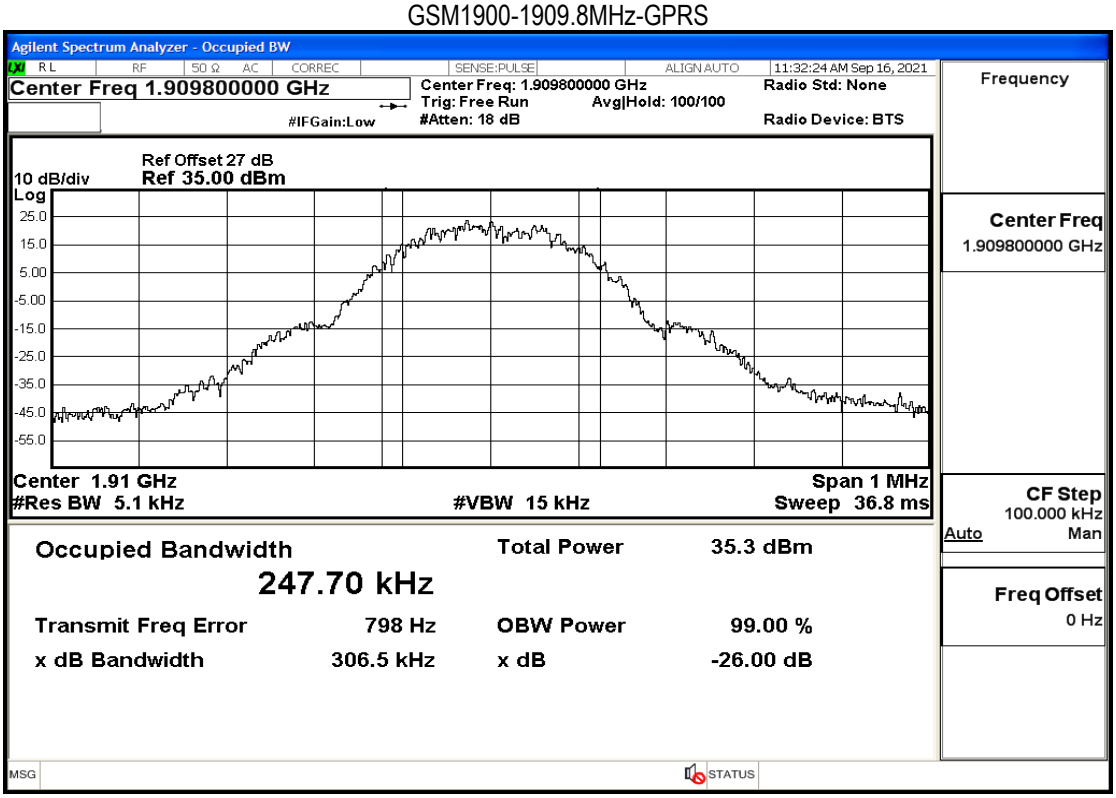
GSM1900-1850.2MHz-GPRS



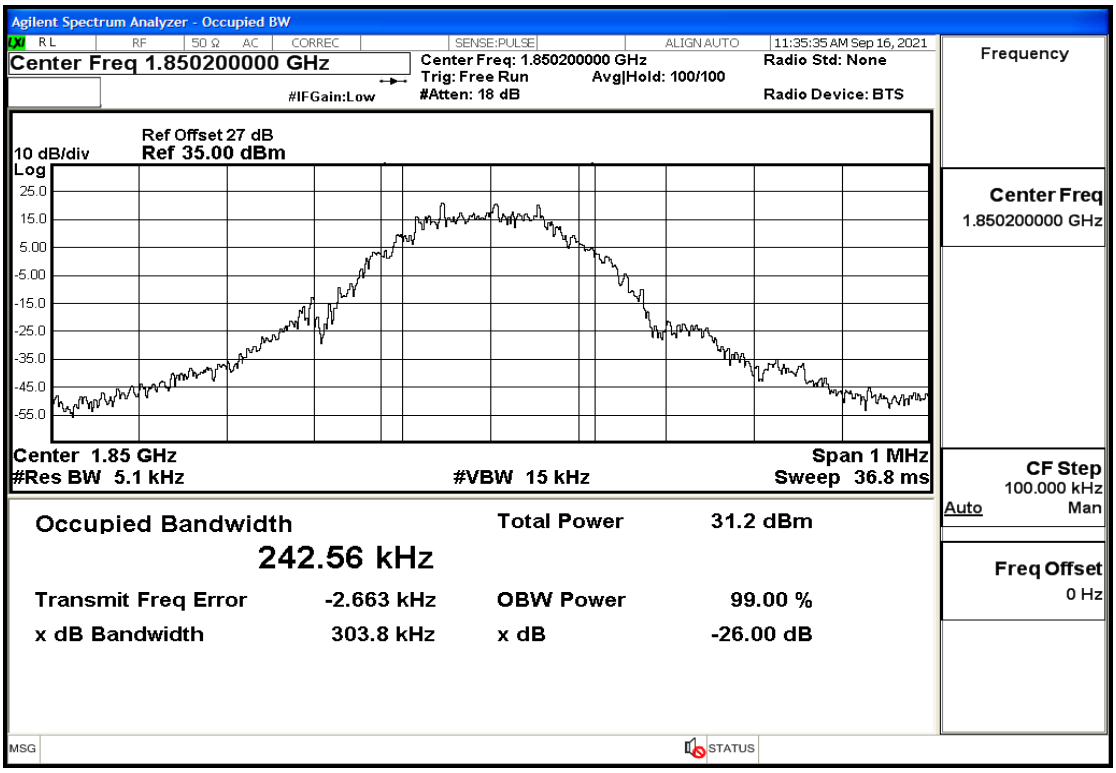
GSM1900-1880MHz-GPRS



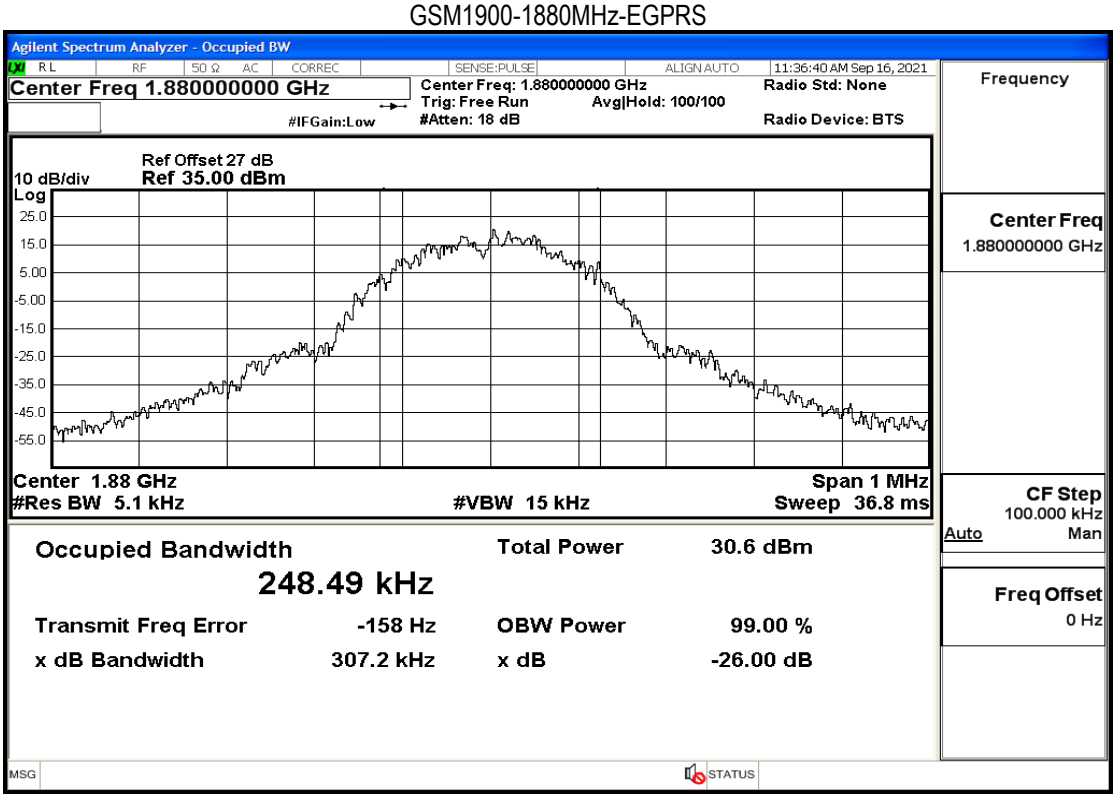
GSM1900-1909.8MHz-GPRS



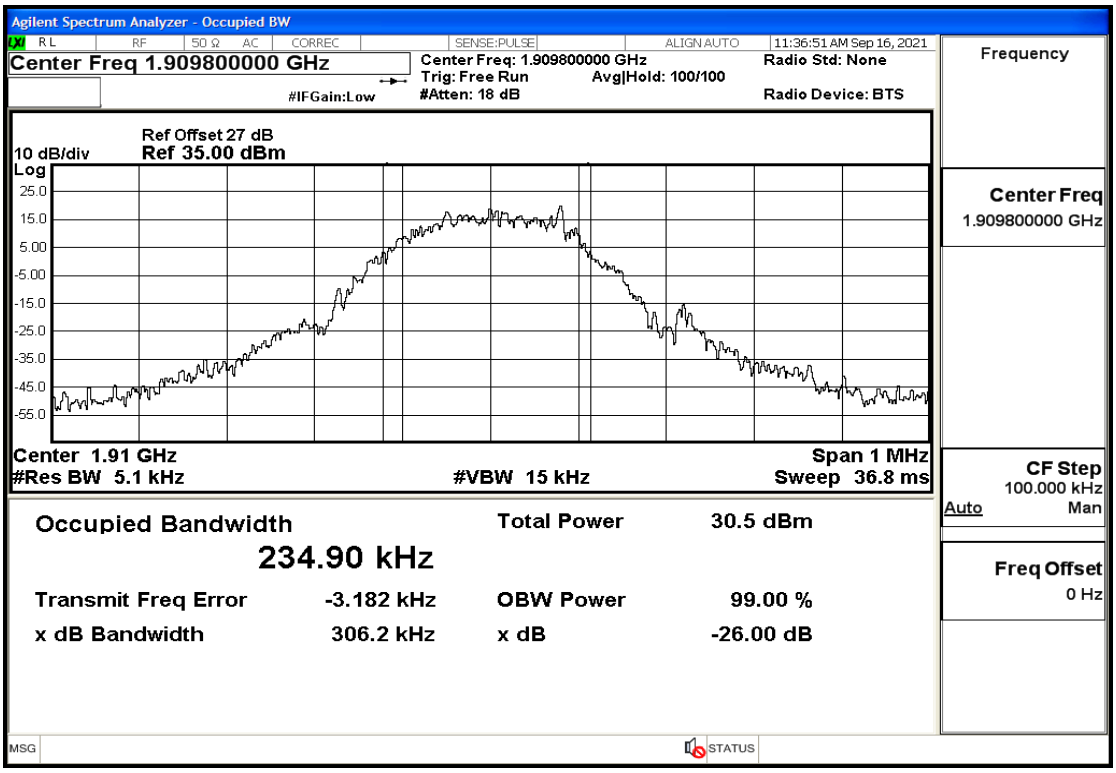
GSM1900-1850.2MHz-EGPRS



GSM1900-1880MHz-EGPRS



GSM1900-1909.8MHz-EGPRS



5.4 BAND EDGE

5.4.1 MEASUREMENT METHOD

1. All out of band emissions are measured with an analyzer spectrum connected to the antenna terminal of the EUT while the EUT at its maximum duty cycle, at maximum power, and at the approximate frequencies. All data rates were investigated to determine the worst case configuration
2. The test set up and general procedure is similar to conducted peak output power test. Only different for setting the measurement configuration of the measuring instrument of Spectrum Analyzer.
3. Start and stop frequency were set such that the band edge would be placed in the center of the plot.
4. Span was set large enough so as to capture all out of band emissions near the band edge.
5. RBW>1% of the emission bandwidth, VBW >=3 x RBW, Detector=RMS, Number of points>=2 x Span/RBW, Trace mode=max hold, Sweep time=auto couple, and the trace was allowed to stabilize

5.4.2 PROVISIONS APPLICABLE

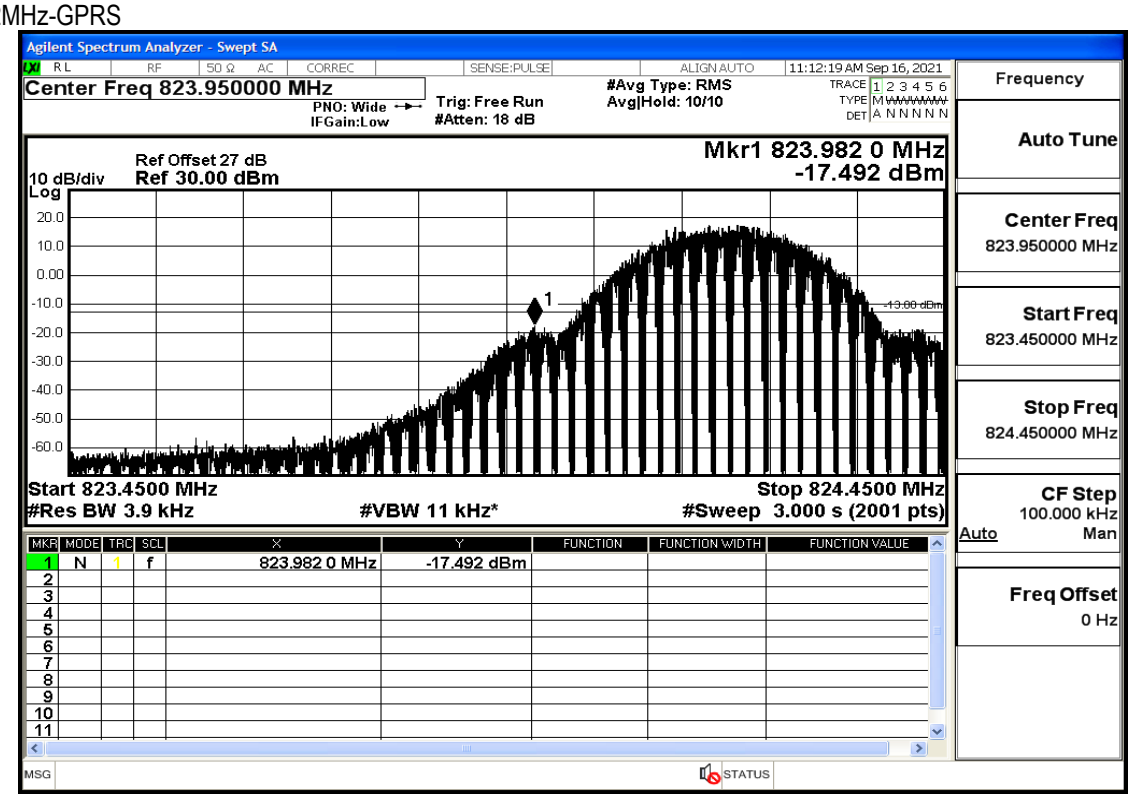
As Specified in FCC rules of 22.917(a), 24.238(a)and KDB 971168 D1 V03R01.

5.4.3 MEASUREMENT RESULT

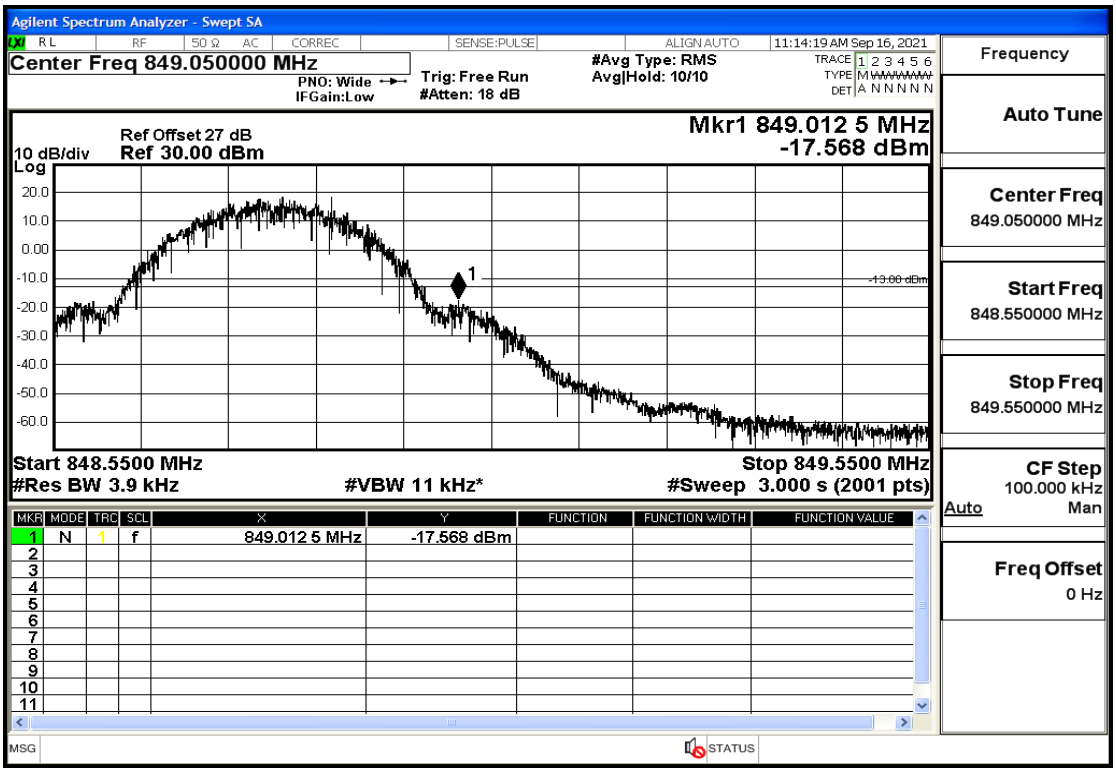
Pass

Temperature	23.9℃	Humidity	56%
Test Engineer	Anna Hu		

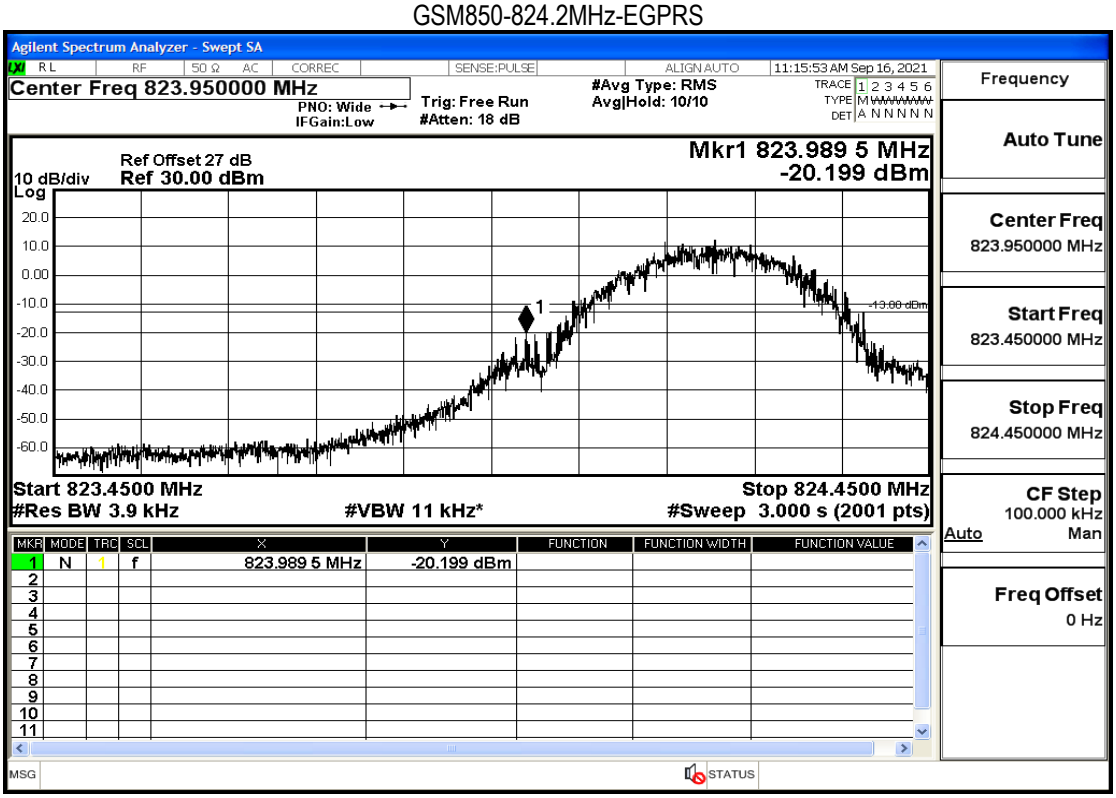
GSM850-824.2MHz-GPRS



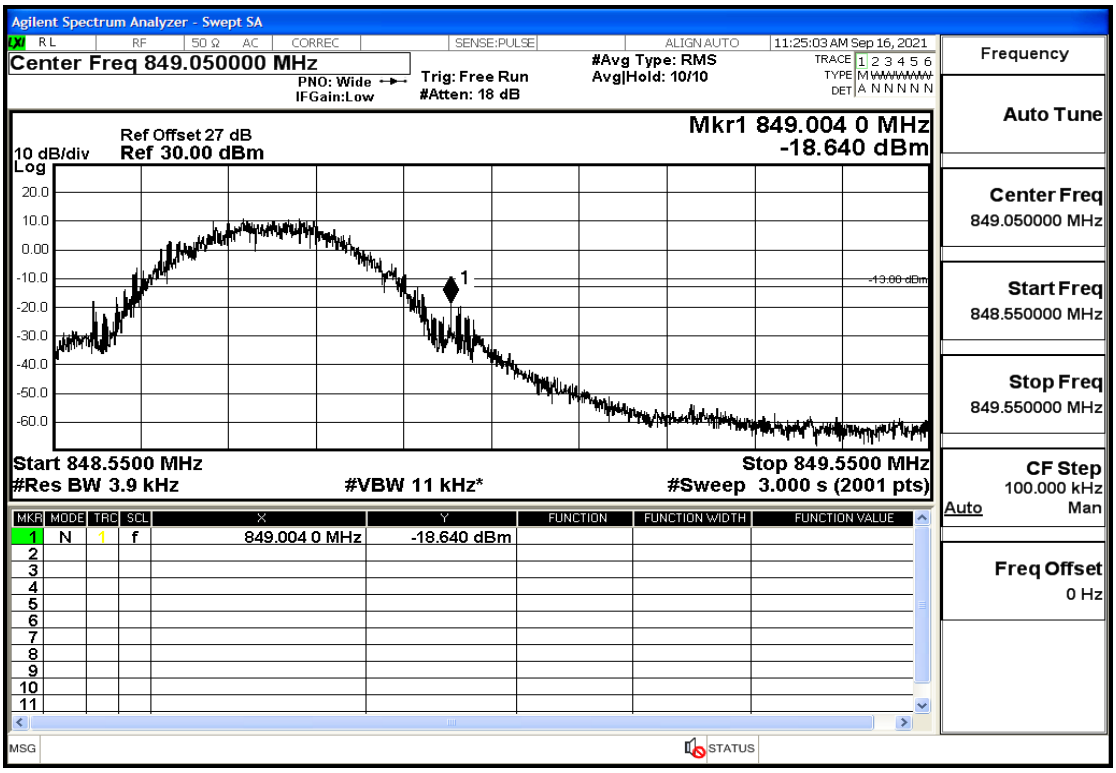
GSM850-848.8MHz-GPRS



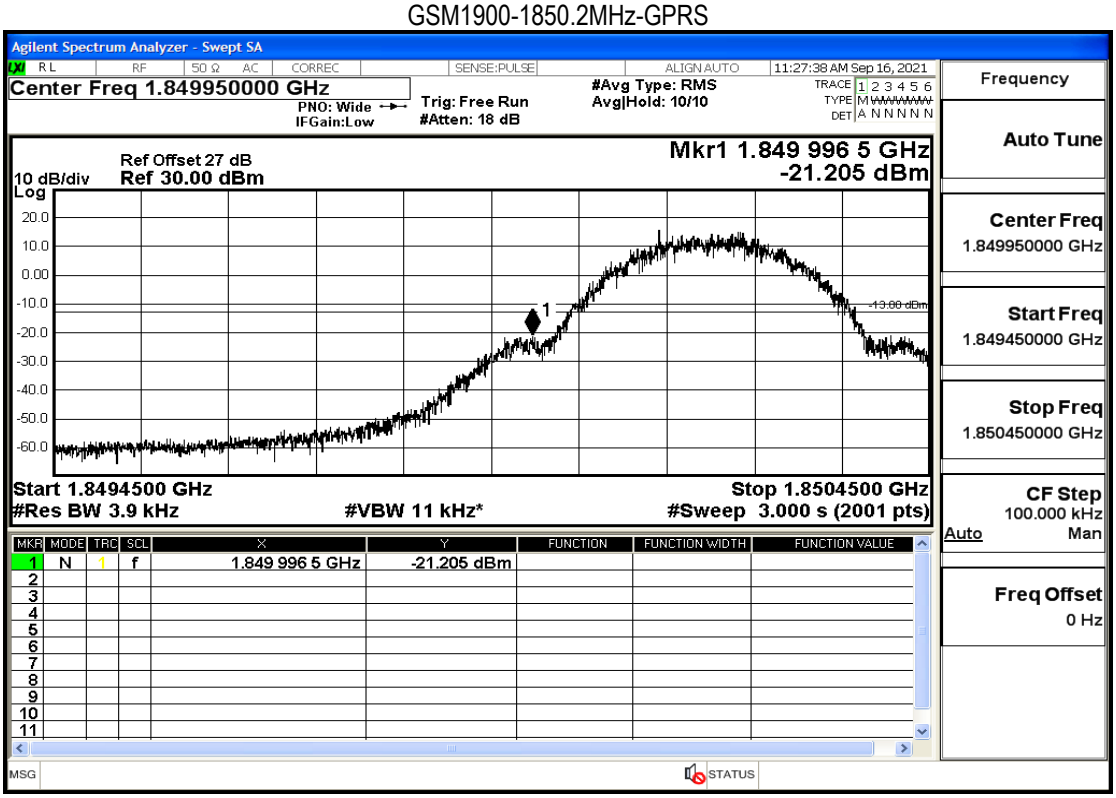
GSM850-824.2MHz-EGPRS



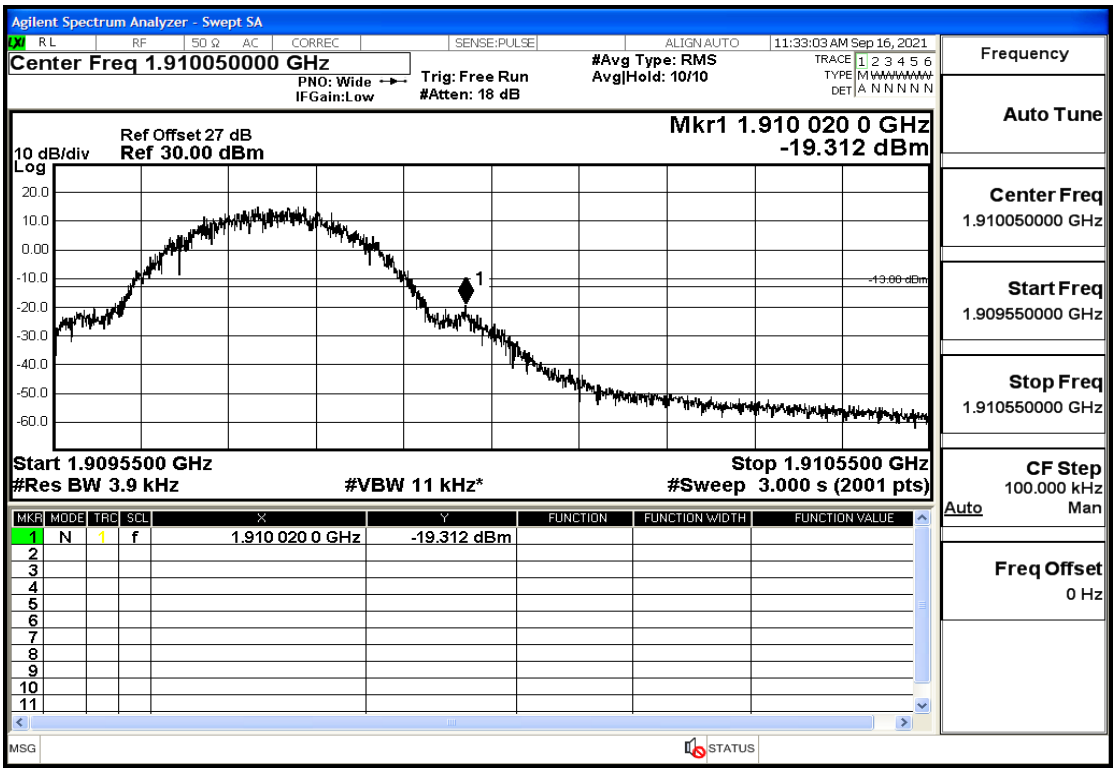
GSM850-848.8MHz-EGPRS



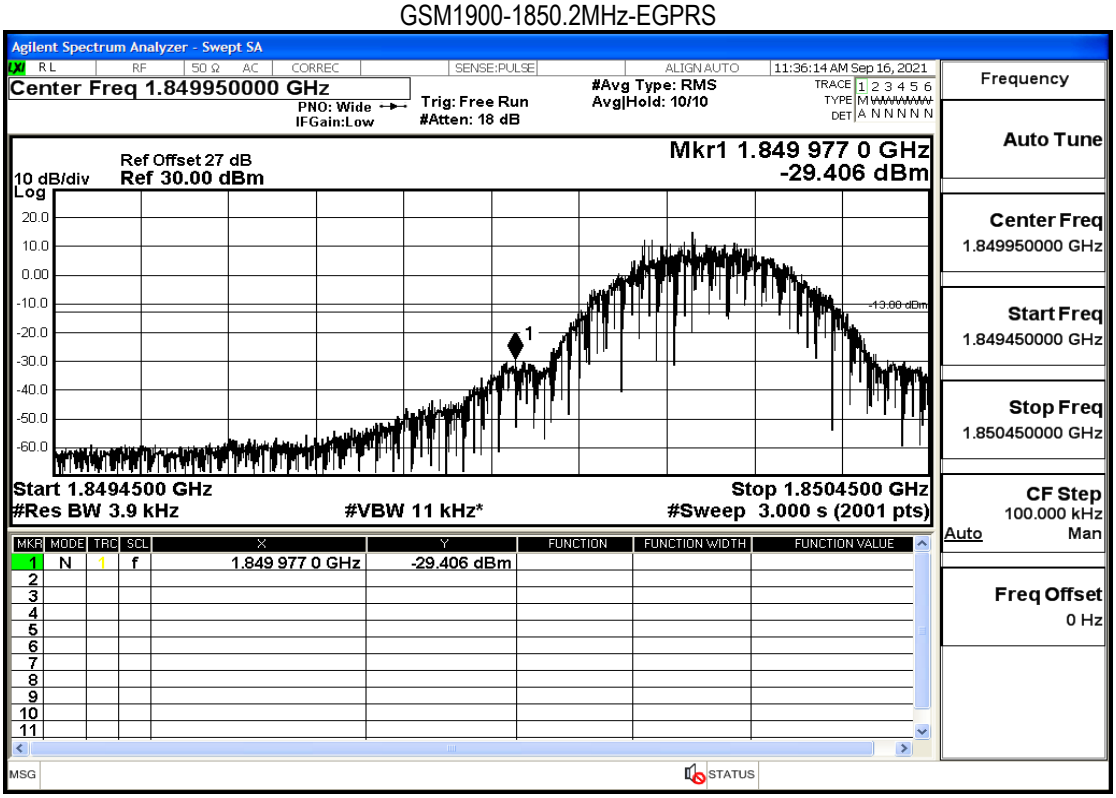
GSM1900-1850.2MHz-GPRS



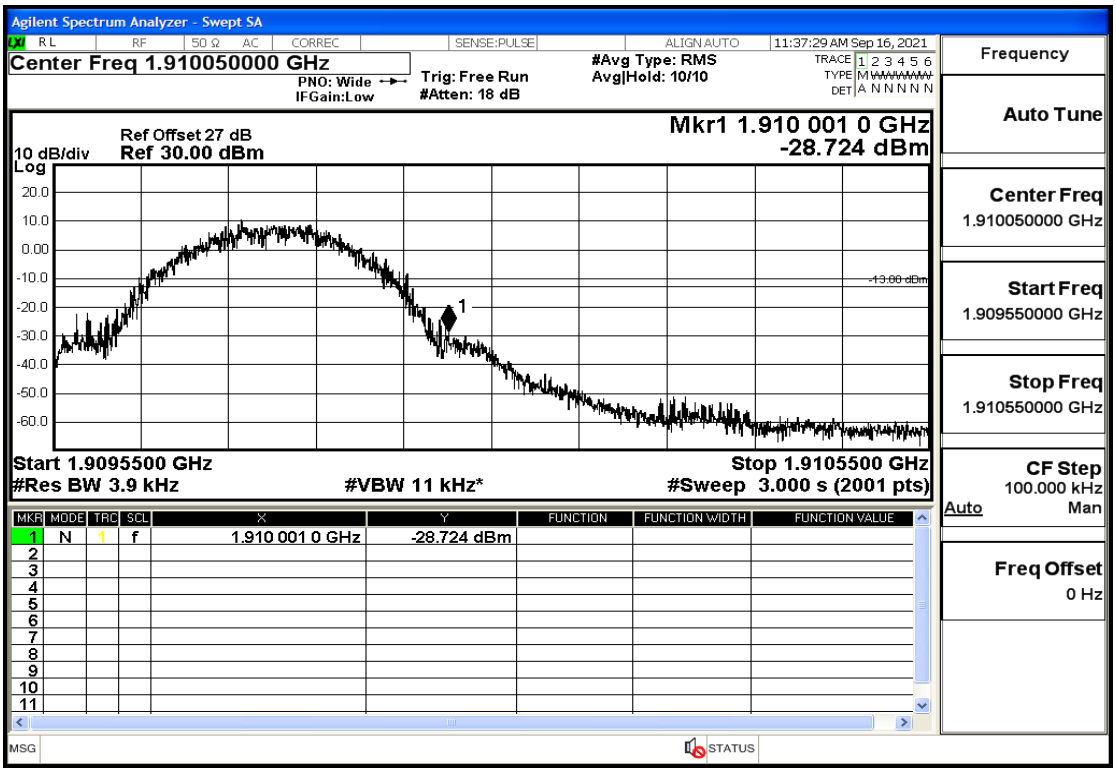
GSM1900-1909.8MHz-GPRS



GSM1900-1850.2MHz-EGPRS



GSM1900-1909.8MHz-EGPRS



5.5 SPURIOUS EMISSION

5.5.1 CONDUCTED SPURIOUS EMISSION

5.5.1.1 MEASUREMENT METHOD

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. The level of the carrier and the various conducted spurious and harmonic frequency is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10^{th} harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the approximate frequencies. All data rates were investigated to determine the worst case configuration.

2. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of PCS1900 band, this equates to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For GSM850, data taken from 30 MHz to 9 GHz.

3. Determine EUT transmit frequencies: the following typical channelswere chosen to conducted emissions testing.

Typical Channels for testing of GSM 850	
Channel	Frequency (MHz)
128	824.2
190	836.6
251	848.8

Typical Channels for testing of PCS 1900	
Channel	Frequency (MHz)
512	1850.2
661	1880.0
810	1909.8

5.5.1.2 PROVISIONS APPLICABLE

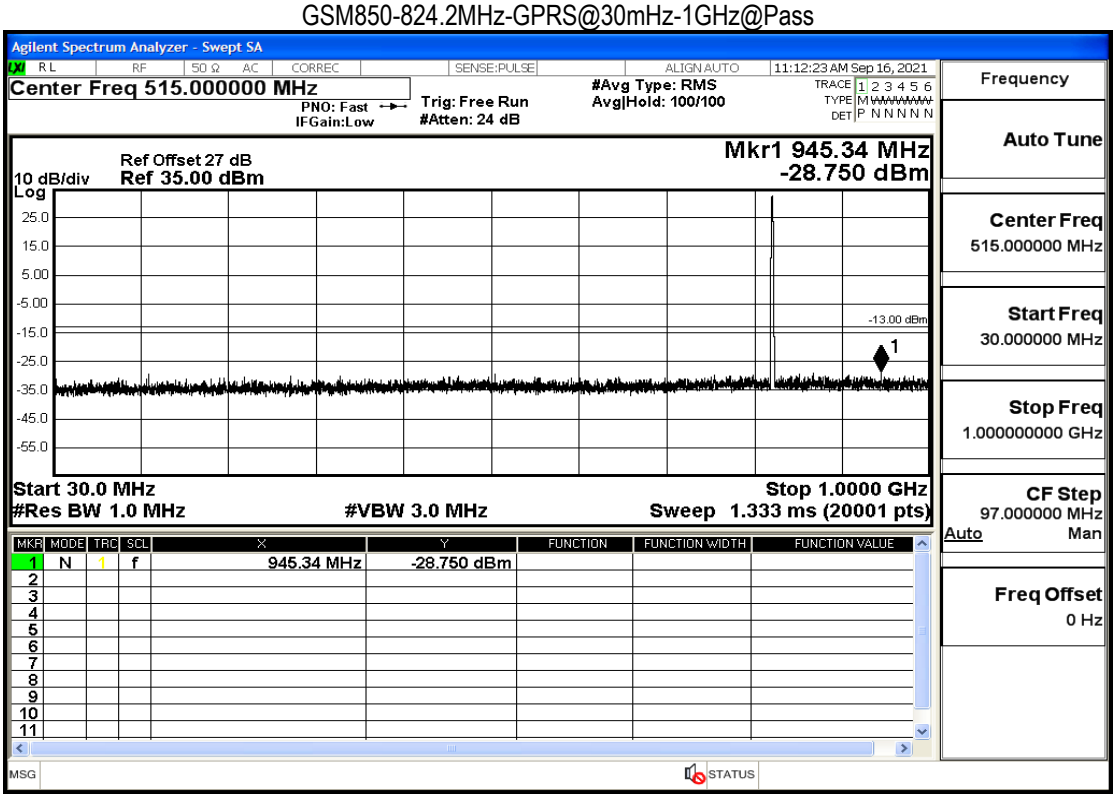
On any frequency outside frequency band of the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

5.5.1.3 MEASUREMENT RESULT

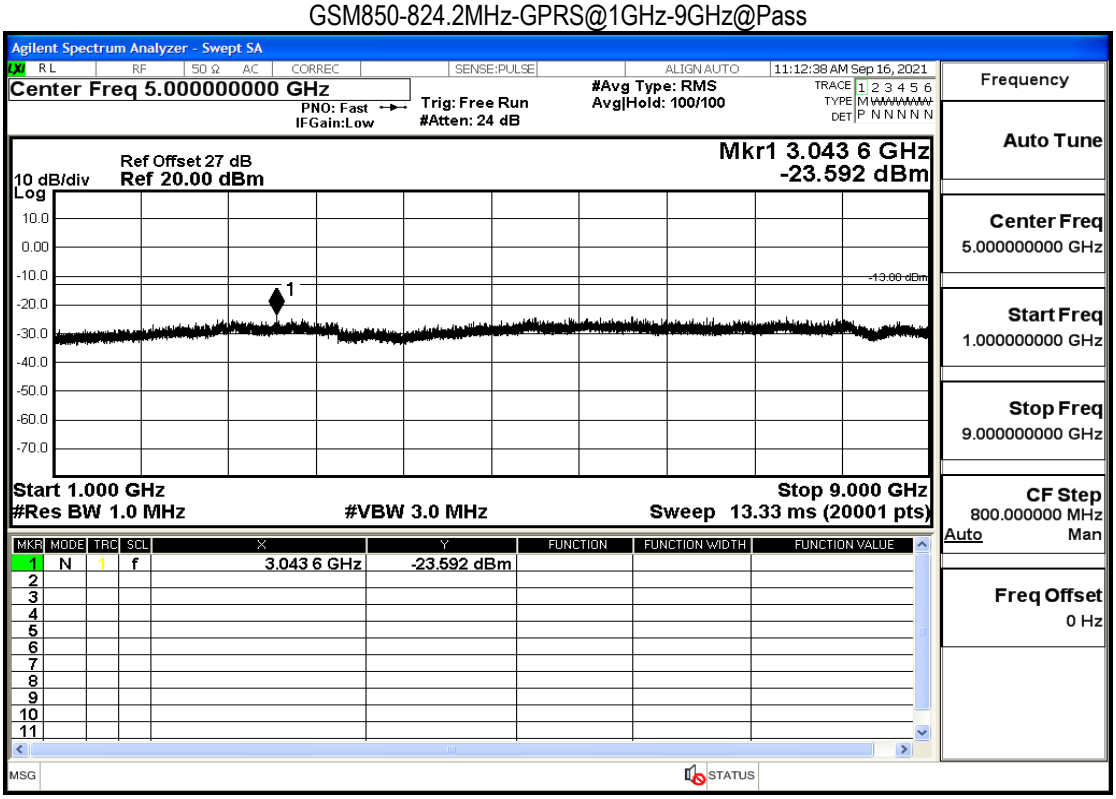
Pass

Temperature	23.9℃	Humidity	56%
Test Engineer	Anna Hu		

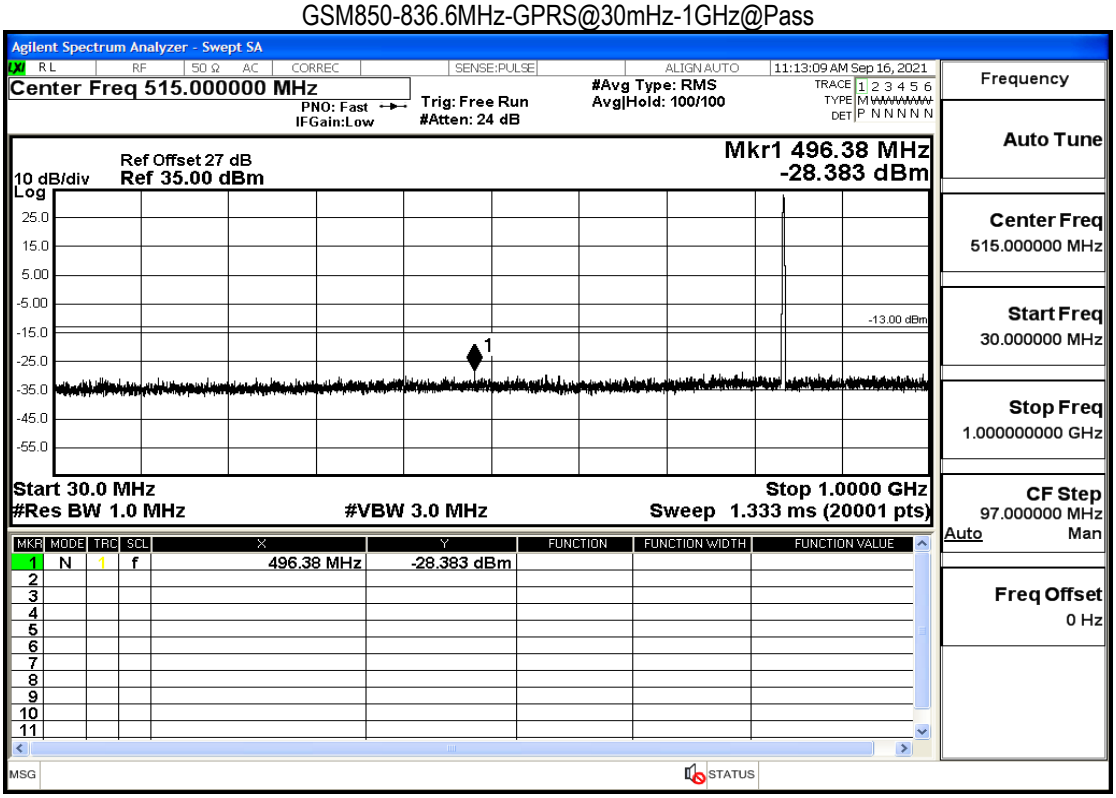
GSM850-824.2MHz-GPRS@30mHz-1GHz@Pass



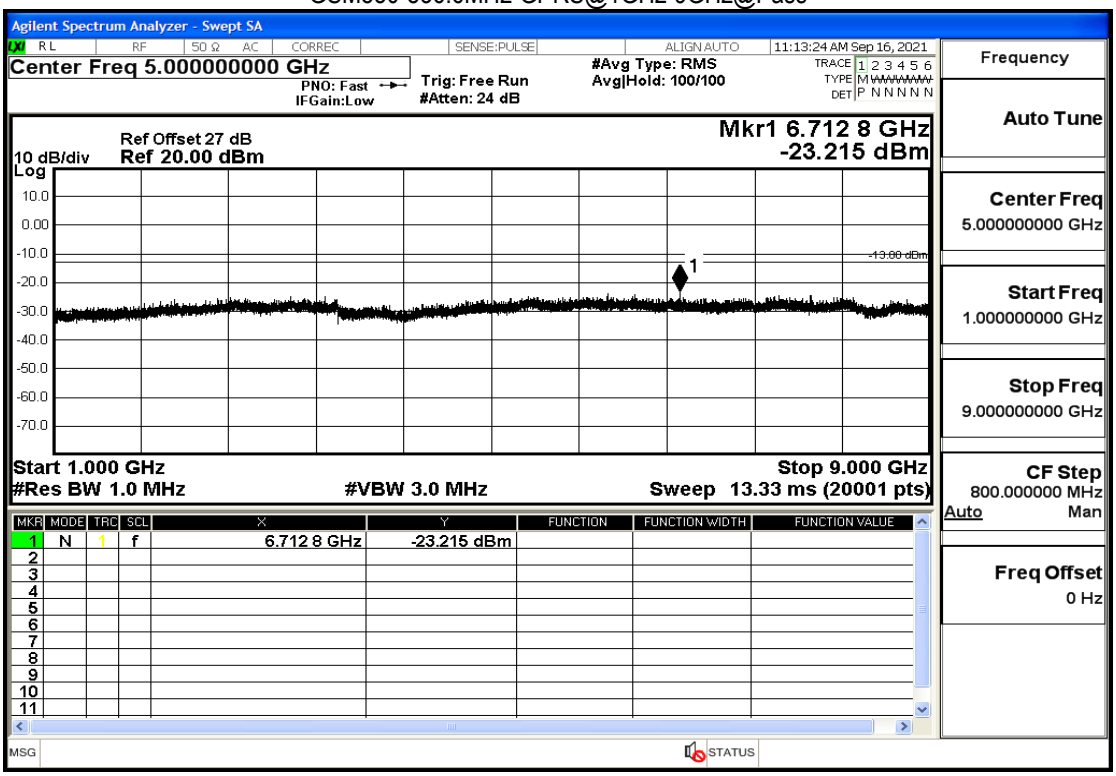
GSM850-824.2MHz-GPRS@1GHz-9GHz@Pass



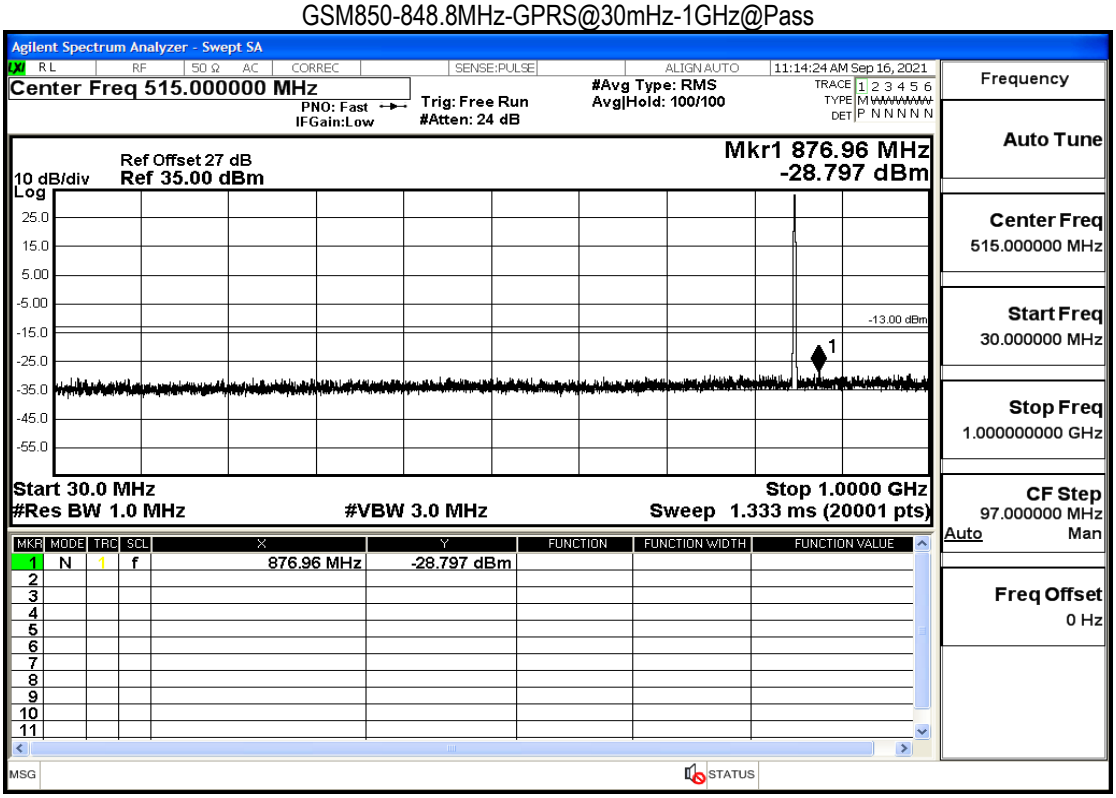
GSM850-836.6MHz-GPRS@30mHz-1GHz@Pass



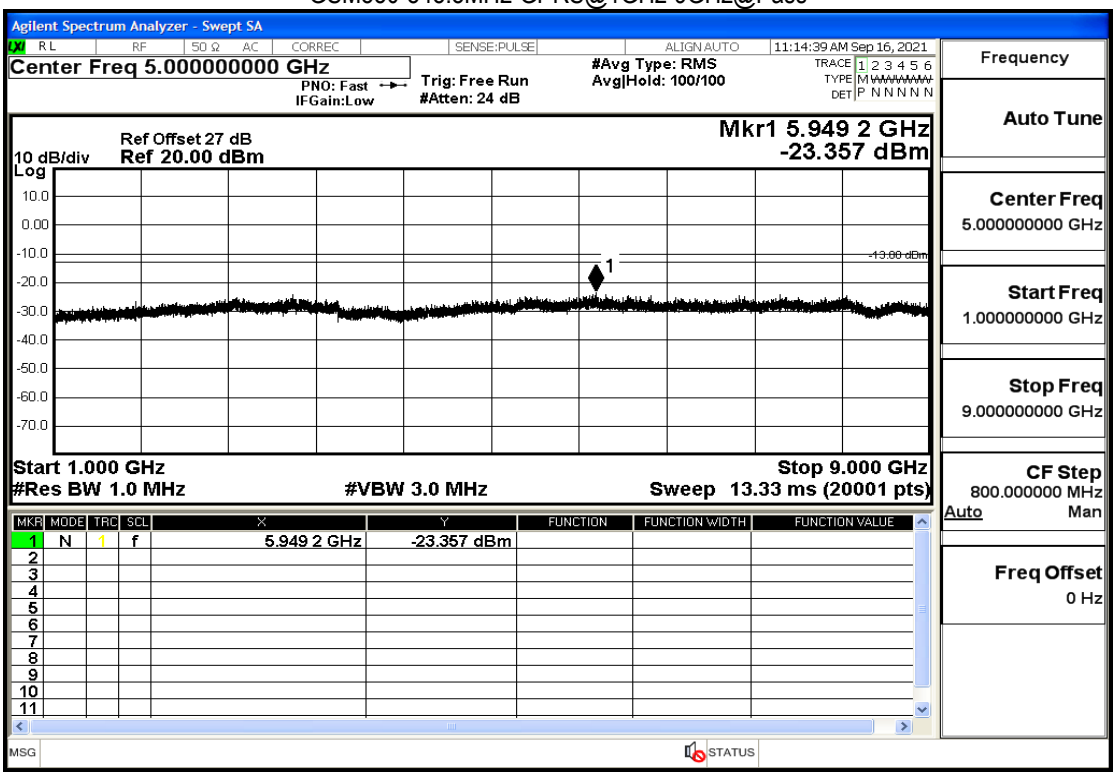
GSM850-836.6MHz-GPRS@1GHz-9GHz@Pass



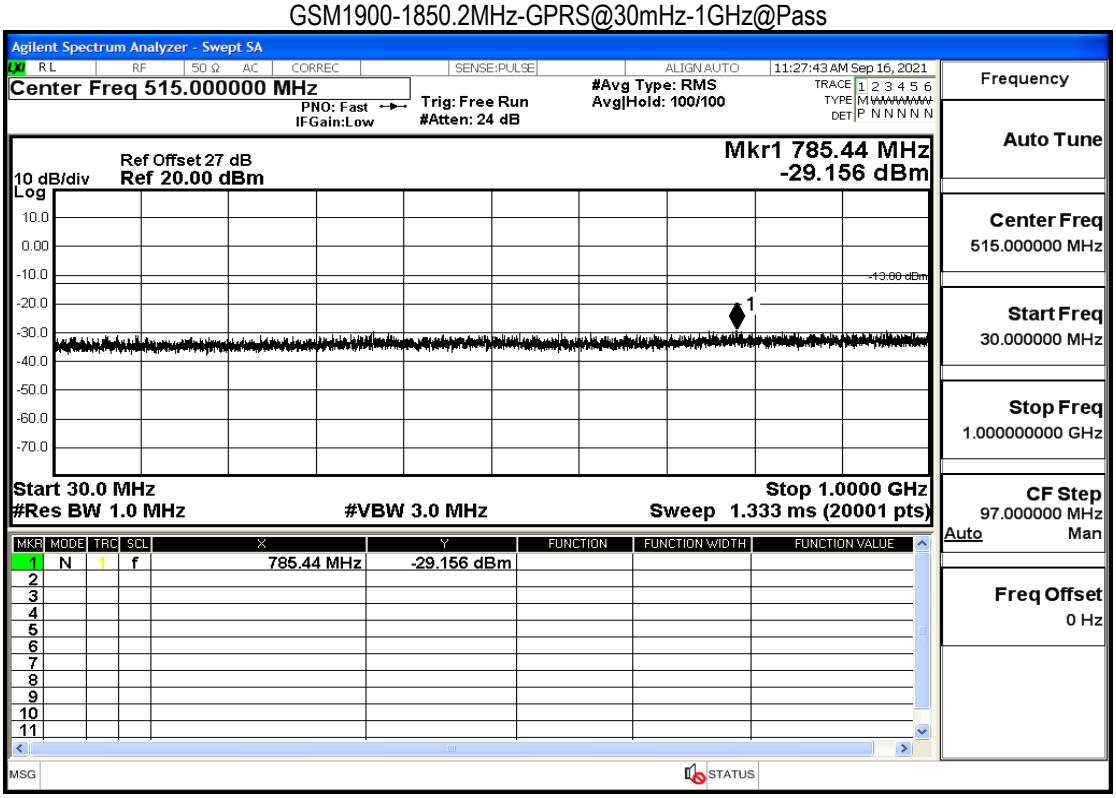
GSM850-848.8MHz-GPRS@30mHz-1GHz@Pass



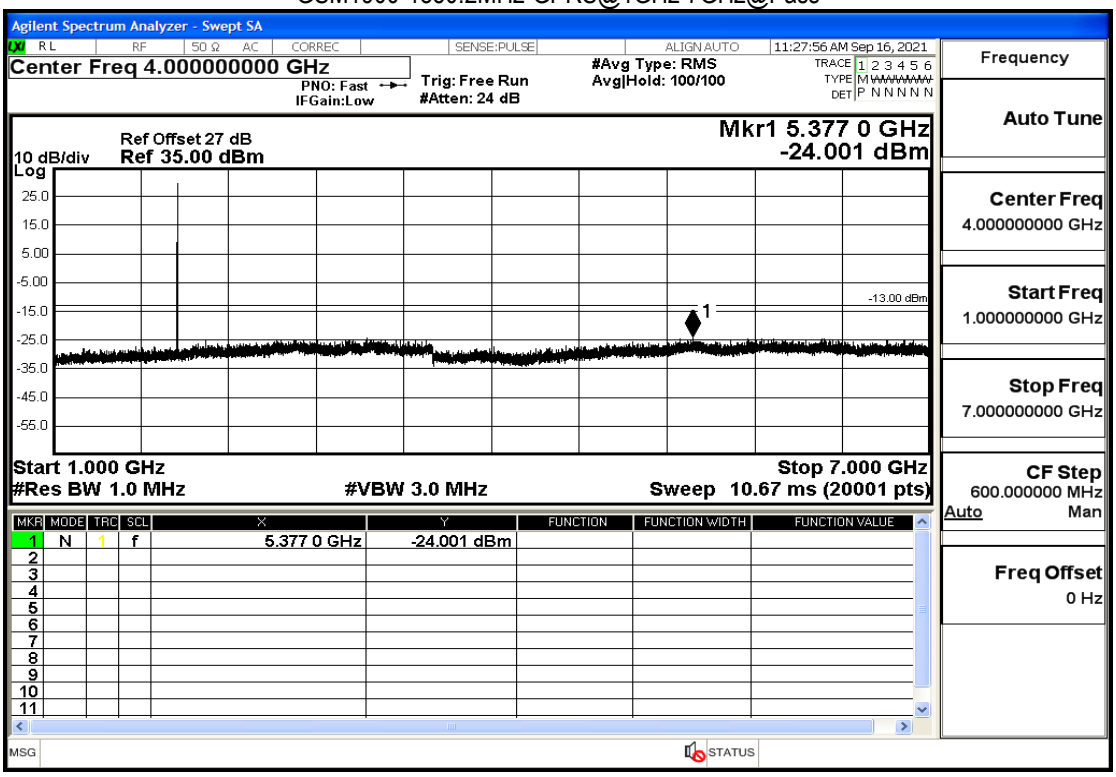
GSM850-848.8MHz-GPRS@1GHz-9GHz@Pass



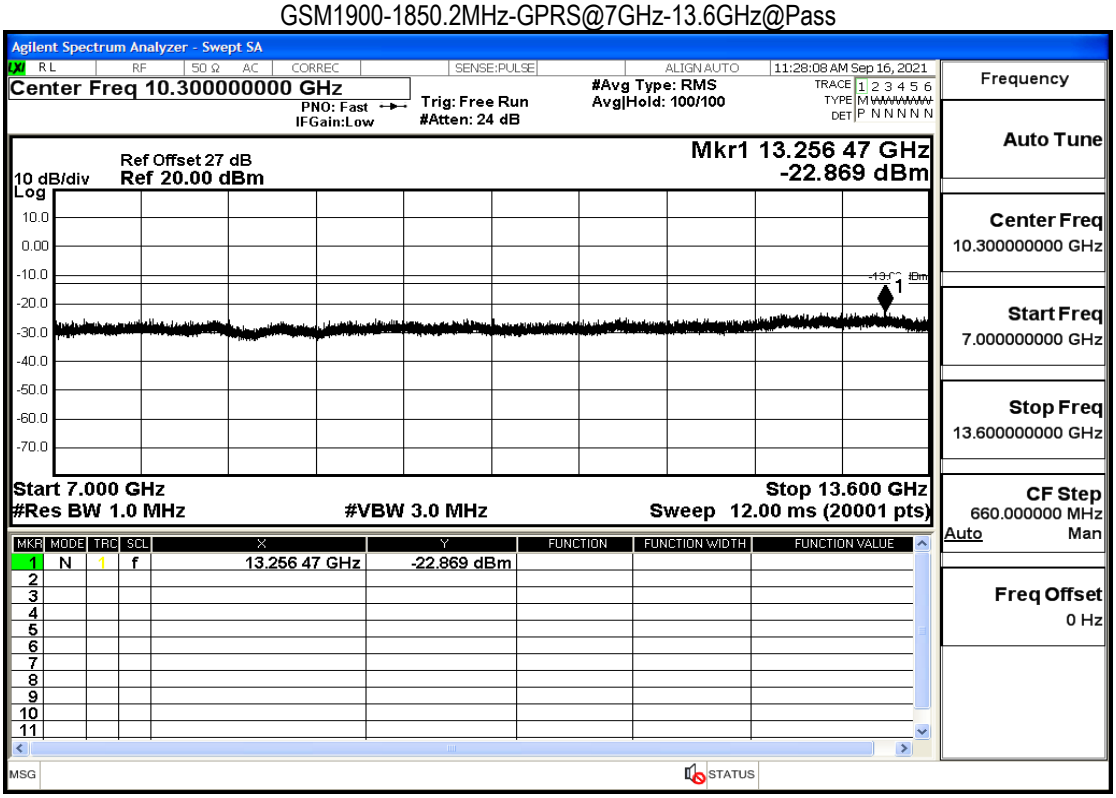
GSM1900-1850.2MHz-GPRS@30mHz-1GHz@Pass



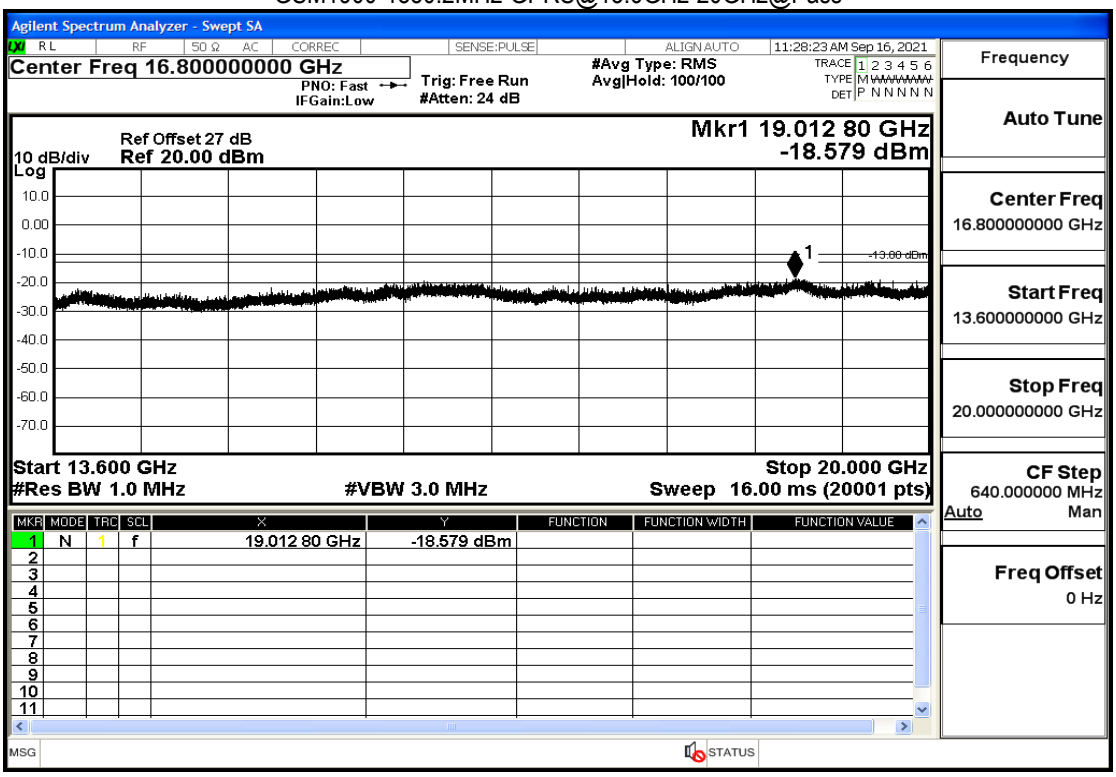
GSM1900-1850.2MHz-GPRS@1GHz-7GHz@Pass



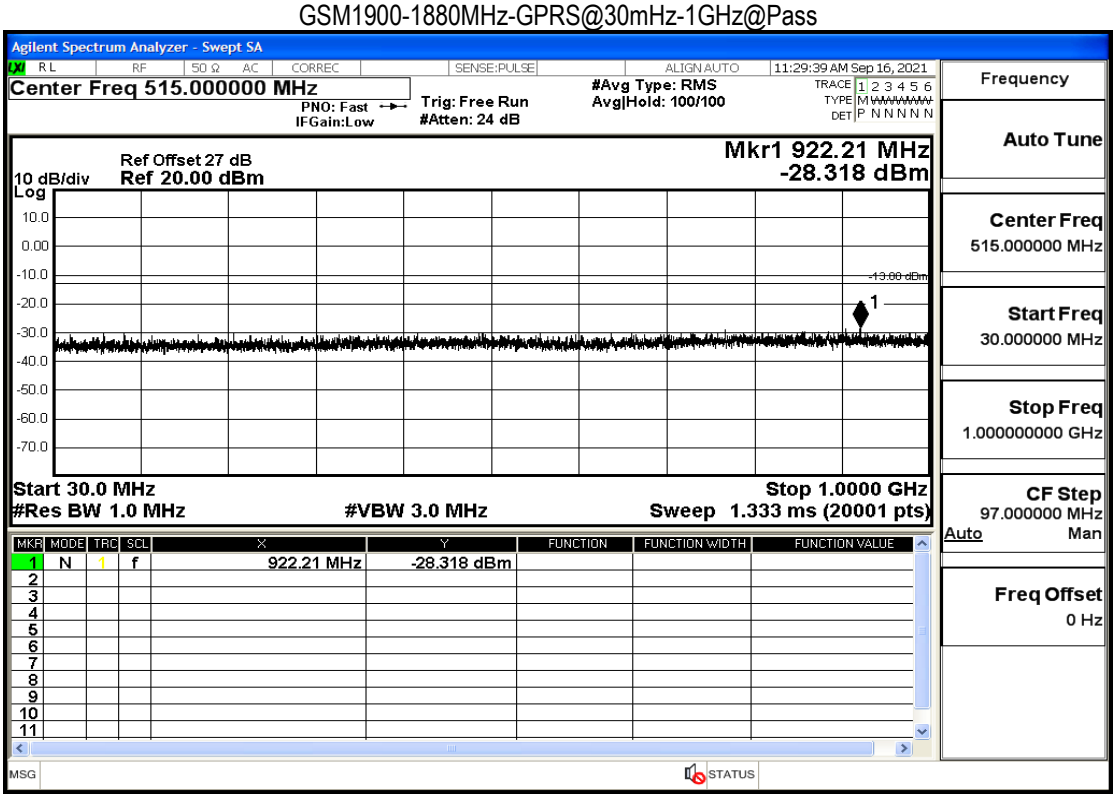
GSM1900-1850.2MHz-GPRS@7GHz-13.6GHz@Pass



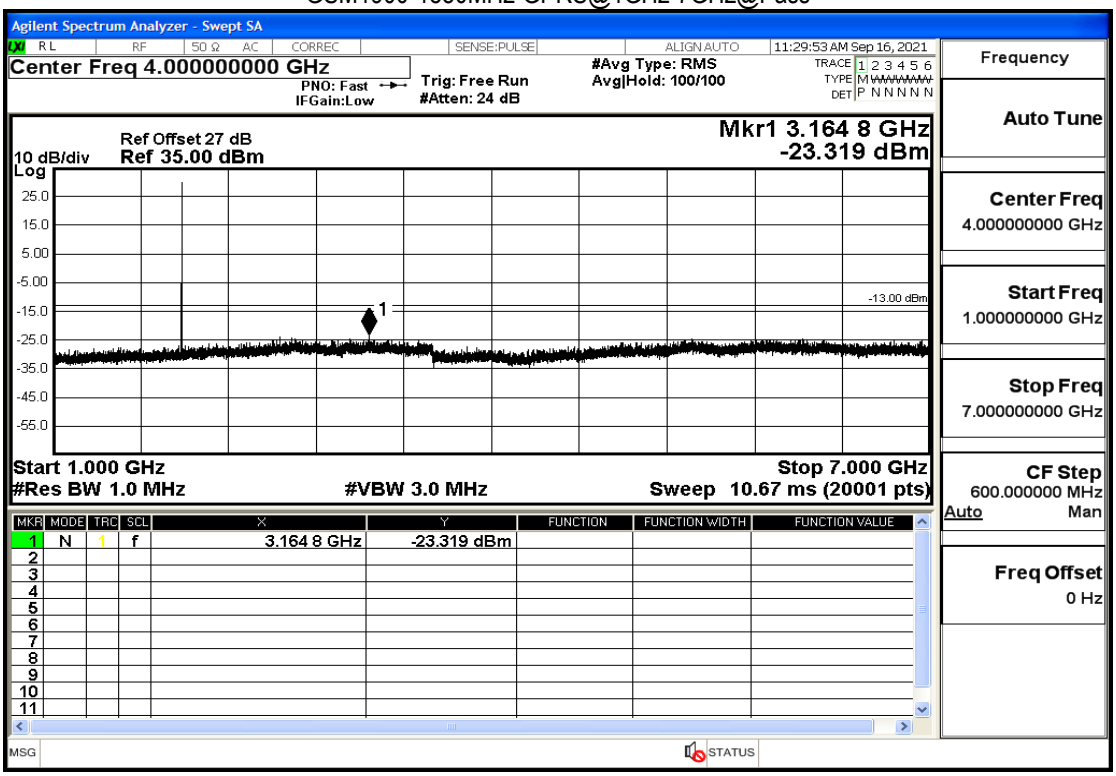
GSM1900-1850.2MHz-GPRS@13.6GHz-20GHz@Pass



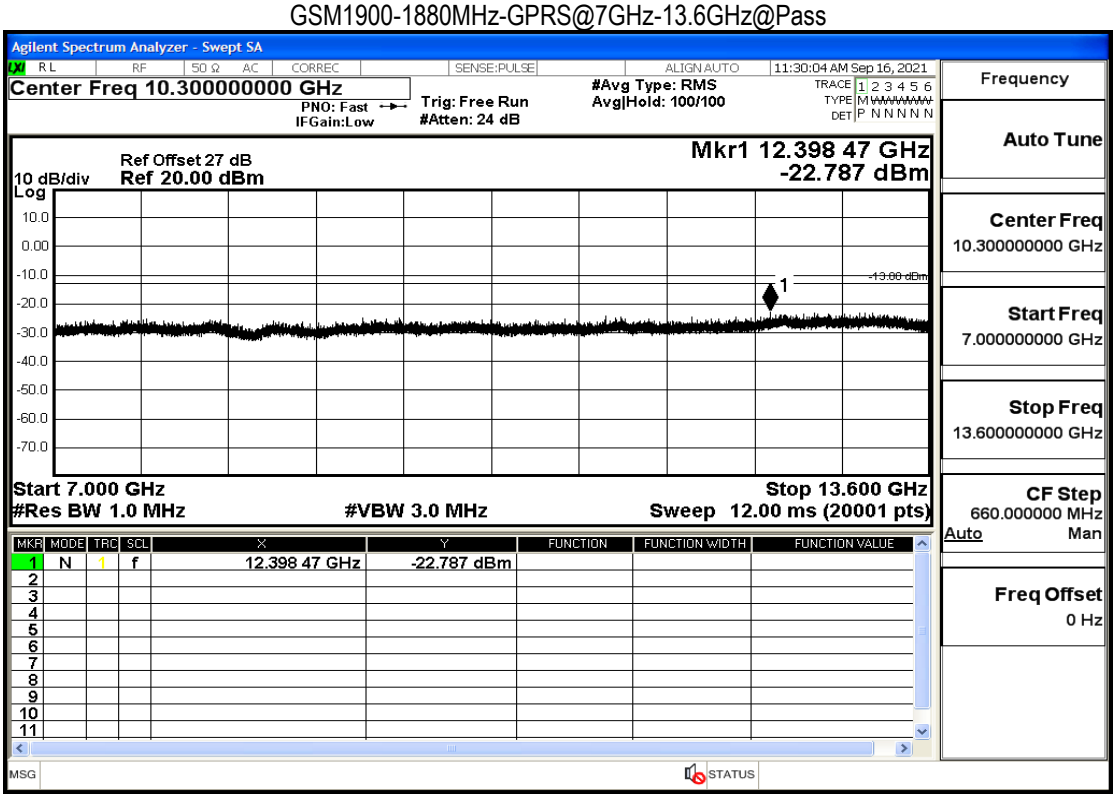
GSM1900-1880MHz-GPRS@30mHz-1GHz@Pass



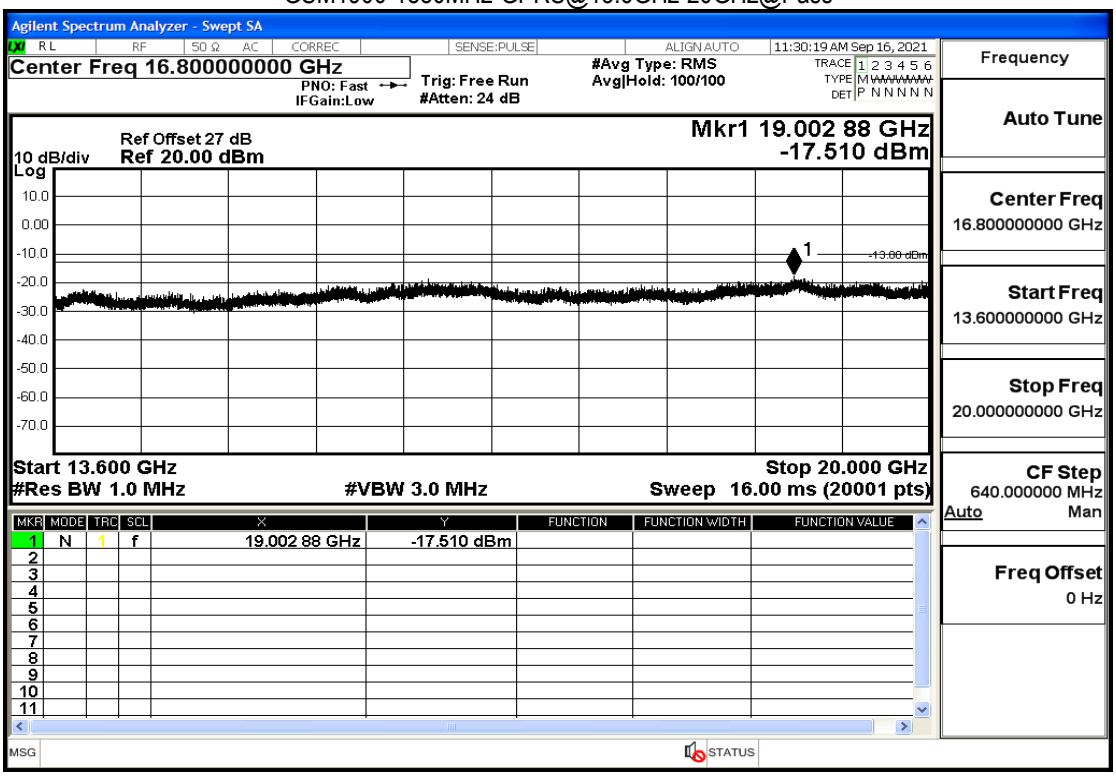
GSM1900-1880MHz-GPRS@1GHz-7GHz@Pass



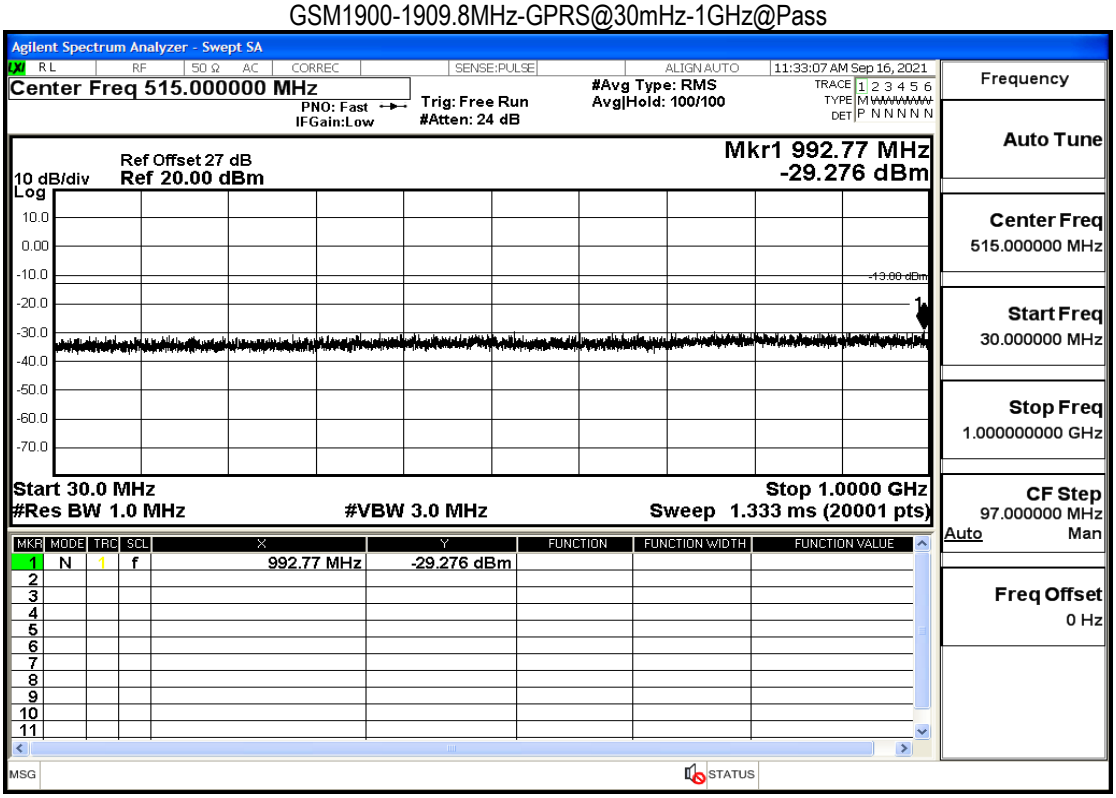
GSM1900-1880MHz-GPRS@7GHz-13.6GHz@Pass



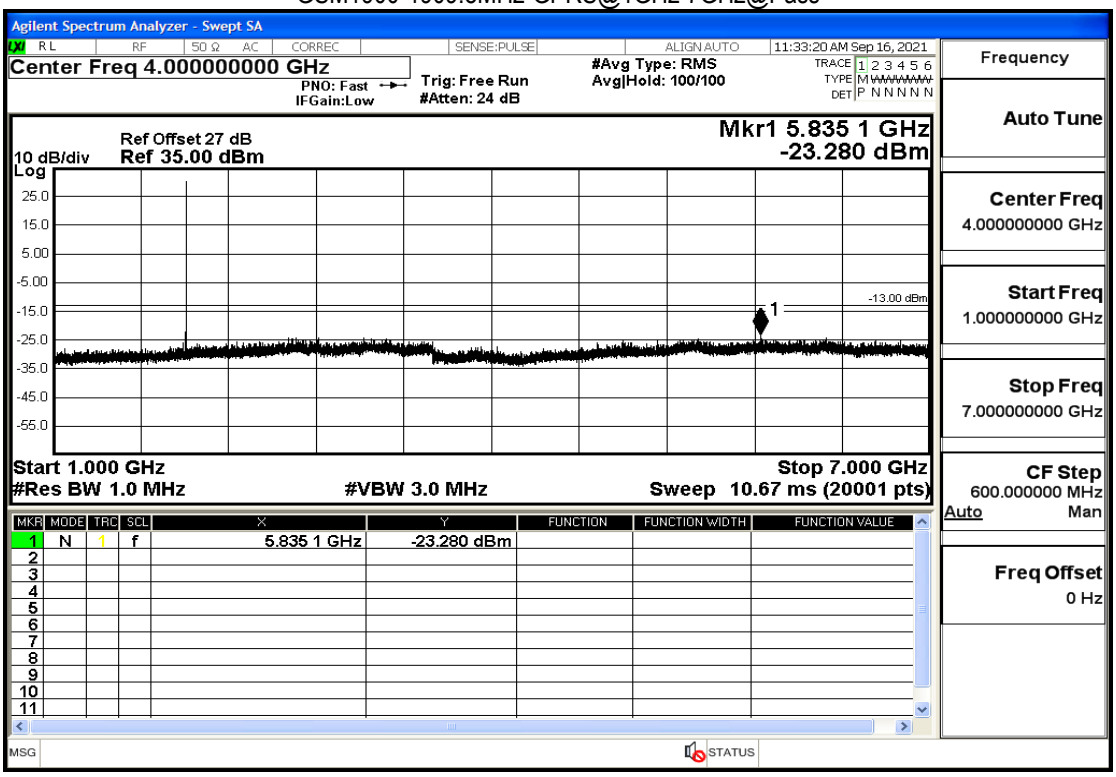
GSM1900-1880MHz-GPRS@13.6GHz-20GHz@Pass



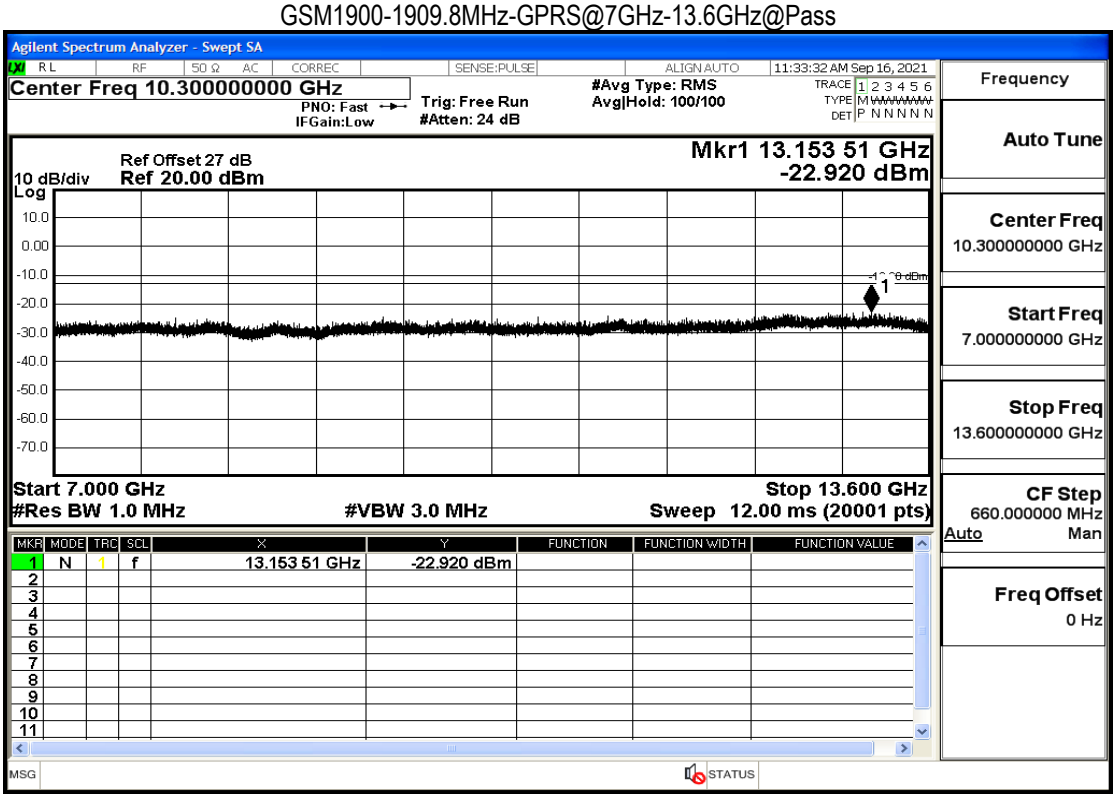
GSM1900-1909.8MHz-GPRS@30mHz-1GHz@Pass



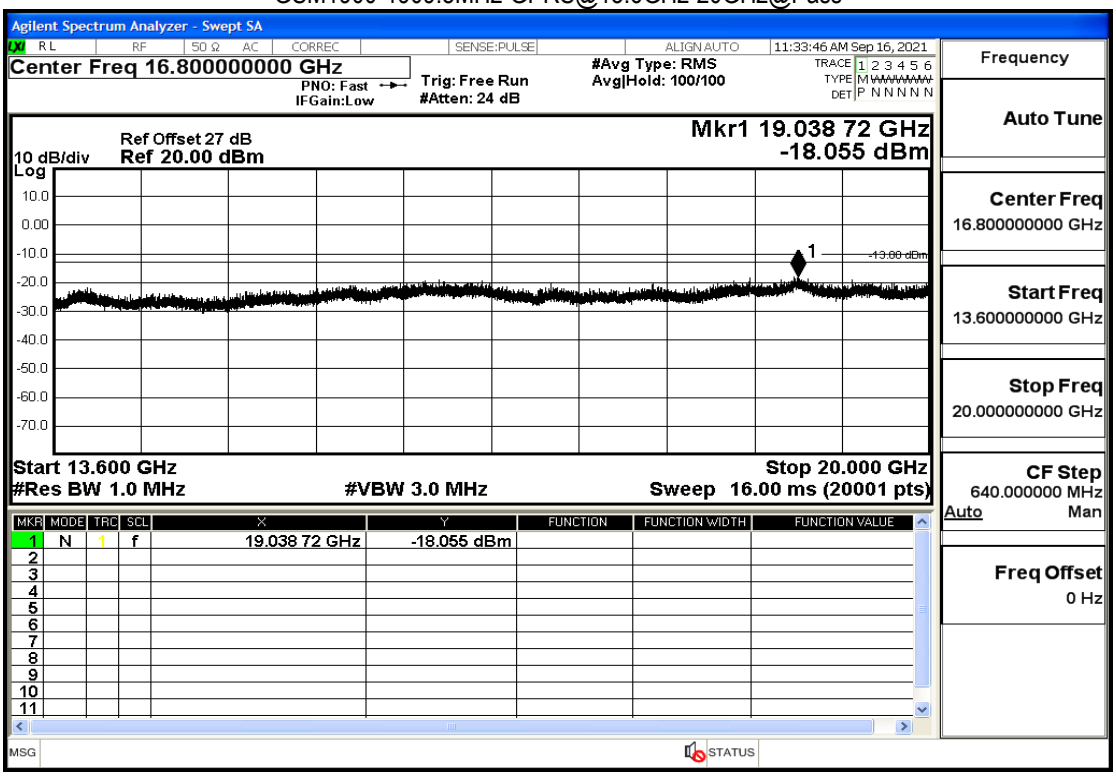
GSM1900-1909.8MHz-GPRS@1GHz-7GHz@Pass



GSM1900-1909.8MHz-GPRS@7GHz-13.6GHz@Pass



GSM1900-1909.8MHz-GPRS@13.6GHz-20GHz@Pass



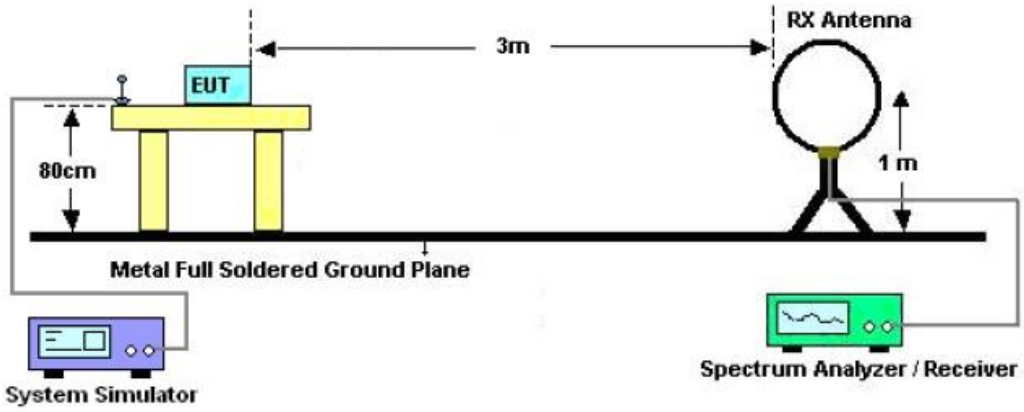
6.1.1 RADIATED SPURIOUS EMISSION

6.1.1.1 MEASUREMENT METHOD

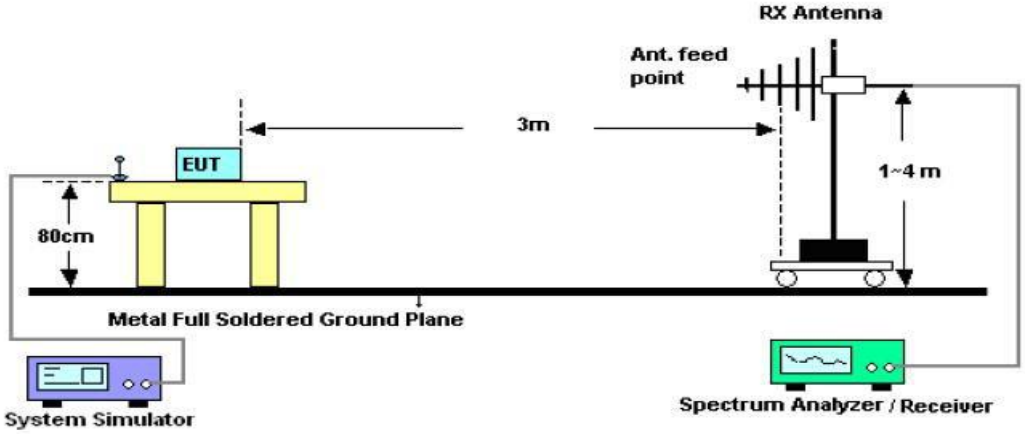
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

6.1.1.2 TEST SETUP

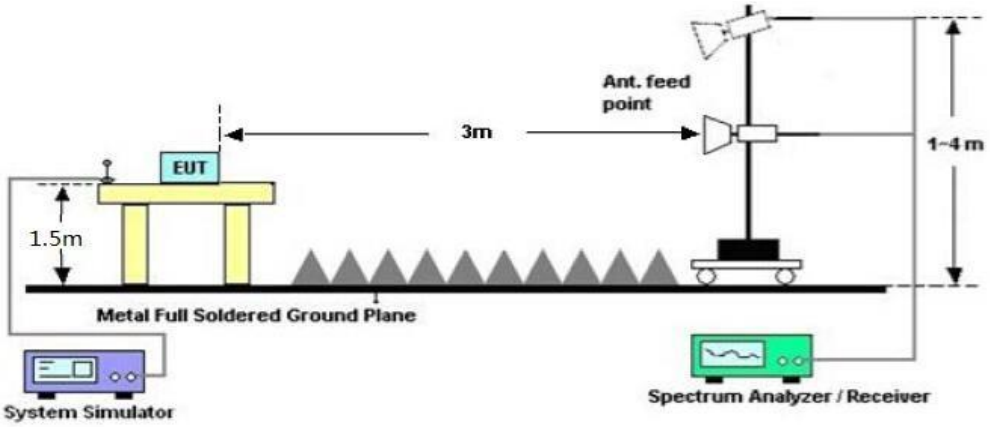
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



6.1.1.3 PROVISIONS APPLICABLE

(a) On any frequency outside a licensee's frequency block (e.g. A, D, B, etc.) within the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. The specification that emissions shall be attenuated below the transmitter power (P) by at

least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

Note: only result the worst condition of each test mode:

6.1.1.4 MEASUREMENT RESULT

Temperature	24.8℃	Humidity	58%
Test Engineer	Anna Hu		

GSM 850:

The Worst Test Results for Channel 128/824.2 MHz				
Frequency	Emission Level	Limits	Margin	Comment
(MHz)	(dBm)	(dBm)	(dB)	
1648.17	-56.67	-13	43.67	Horizontal
3296.52	-41.40	-13	28.40	Horizontal
4944.97	-53.16	-13	40.16	Horizontal
1648.16	-42.49	-13	29.49	Vertical
3296.44	-49.01	-13	36.01	Vertical
4944.84	-47.20	-13	34.20	Vertical

PCS 1900:

The Worst Test Results for Channel 661/1880.0 MHz				
Frequency	Emission Level	Limits	Margin	Comment
(MHz)	(dBm)	(dBm)	(dB)	
3759.64	-57.42	-13	44.42	Horizontal
7519.69	-37.03	-13	24.03	Horizontal
11279.71	-53.86	-13	40.86	Horizontal
3759.76	-39.43	-13	26.43	Vertical
7519.74	-50.05	-13	37.05	Vertical
11279.63	-45.68	-13	32.68	Vertical

RESULT: PASS

Note:

1. Margin = Limit - Emission Level
2. Below 30MHZ no Spurious found and Above is the worst mode data.

6.2 FREQUENCY STABILITY

6.2.1 MEASUREMENT METHOD

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.

1 Measure the carrier frequency at room temperature.

2 Subject the EUT to overnight soak at -10℃.

3 With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on channel 661 for PCS 1900 band , channel 190 for GSM 850 band measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.

4 Repeat the above measurements at 10℃ increments from -10℃ to +50℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.

5 Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.

6 Subject the EUT to overnight soak at +50℃.

7 With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.

8 Repeat the above measurements at 10℃ increments from +50℃ to -10℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.

9 At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

6.2.2 PROVISIONS APPLICABLE

6.2.2.1 FOR HAND CARRIED BATTERY POWERED EQUIPMENT

According to the ANSI/TIA-603-E-2016, the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.5VDC and 4.2VDC, with a nominal voltage of 3.7VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance of -10 % and +12.5 %. For the purposes of measuring frequency stability these voltage limits are to be used.

6.2.2.2 FOR EQUIPMENT POWERED BY PRIMARY SUPPLY VOLTAGE

According to the ANSI/TIA-603-E-2016,the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment, the normal environment temperature is 20^{o}C.

6.2.3 MEASUREMENT RESULT

Pass

For GSM
Test Band=GSM850/GSM1900

Voltage							
Band	Channel	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Verdict
GPRS850	128	VL	TN	3.2	0.0038	2.5	PASS
GPRS850	128	VN	TN	4.16	0.0050	2.5	PASS
GPRS850	128	VH	TN	5.45	0.0065	2.5	PASS
GPRS850	190	VL	TN	5.79	0.0069	2.5	PASS
GPRS850	190	VN	TN	5.26	0.0063	2.5	PASS
GPRS850	190	VH	TN	1.62	0.0019	2.5	PASS
GPRS850	251	VL	TN	6.59	0.0079	2.5	PASS
GPRS850	251	VN	TN	6.57	0.0079	2.5	PASS
GPRS850	251	VH	TN	4.85	0.0058	2.5	PASS
EGPRS850	128	VL	TN	13.25	0.0158	2.5	PASS
EGPRS850	128	VN	TN	10.26	0.0123	2.5	PASS
EGPRS850	128	VH	TN	11.86	0.0142	2.5	PASS
EGPRS850	190	VL	TN	12.4	0.0148	2.5	PASS
EGPRS850	190	VN	TN	13.4	0.0160	2.5	PASS
EGPRS850	190	VH	TN	13.07	0.0156	2.5	PASS
EGPRS850	251	VL	TN	12.5	0.0150	2.5	PASS
EGPRS850	251	VN	TN	12.41	0.0148	2.5	PASS
EGPRS850	251	VH	TN	10.35	0.0124	2.5	PASS
GPRS1900	512	VL	TN	8.27	0.0044	2.5	PASS
GPRS1900	512	VN	TN	9.42	0.0050	2.5	PASS
GPRS1900	512	VH	TN	13.77	0.0073	2.5	PASS
GPRS1900	661	VL	TN	24.59	0.0131	2.5	PASS
GPRS1900	661	VN	TN	24.16	0.0129	2.5	PASS
GPRS1900	661	VH	TN	32.13	0.0171	2.5	PASS
GPRS1900	810	VL	TN	25.4	0.0135	2.5	PASS
GPRS1900	810	VN	TN	21.46	0.0114	2.5	PASS
GPRS1900	810	VH	TN	28.01	0.0149	2.5	PASS
EGPRS1900	512	VL	TN	28.72	0.0153	2.5	PASS
EGPRS1900	512	VN	TN	29.49	0.0157	2.5	PASS
EGPRS1900	512	VH	TN	30.17	0.0160	2.5	PASS
EGPRS1900	661	VL	TN	33.71	0.0179	2.5	PASS
EGPRS1900	661	VN	TN	37.07	0.0197	2.5	PASS
EGPRS1900	661	VH	TN	37.76	0.0201	2.5	PASS
EGPRS1900	810	VL	TN	29.55	0.0157	2.5	PASS
EGPRS1900	810	VN	TN	31.81	0.0169	2.5	PASS
EGPRS1900	810	VH	TN	28.99	0.0154	2.5	PASS

7 Test Set up Photos of the EUT

Please refer to separated files for Test Setup Photos of the EUT.

8 External Photos of the EUT

Please refer to separated files for External Photos of the EUT.

9 Internal Photos of the EUT

Please refer to separated files for Internal Photos of the EUT.

**********End of Report **********