



中认信通

CHINA CERTIFICATION ICT CO., LTD (DONGGUAN)



TEST REPORT

Applicant: ShenZhen SolidRF Communications Co., Ltd

Address: No. 8, Shop D, Block C, Shan Shui Ju, Long Wei Rd Shenzhen
China

FCC ID: A7V-SR15652001

Product Name: Signal Booster

Standard(s): FCC Part 20.21
ANSI C63.26-2015
KDB 935210 D03 Signal Booster Measurements v04r04
FCC Part 1.1310 & 2.1091

The above equipment has been tested and found compliance with the requirement of the relative standards by China Certification ICT Co., Ltd (Dongguan)

Report Number: PCR220822001-00A

Date Of Issue: 2022-09-05

Reviewed By: Sun Zhong

Title: Manager

Sun Zhong

Test Laboratory: China Certification ICT Co., Ltd (Dongguan)

No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China

Tel: +86-769-82016888

Test Facility

The Test site used by *China Certification ICT Co., Ltd (Dongguan)* to collect test data is located on the No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 442868, the FCC Designation No. : CN1314.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0123.

Declarations

China Certification ICT Co., Ltd (Dongguan) is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

This report cannot be reproduced except in full, without prior written approval of the Company.

This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

This report may contain data that are not covered by the accreditation scope and shall be marked with an asterisk “★”.

CONTENTS

TEST FACILITY	2
DECLARATIONS	2
DOCUMENT REVISION HISTORY.....	4
1. GENERAL INFORMATION.....	5
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	5
1.2 TECHNICAL SPECIFICATION	5
1.3 ANTENNA & COAXIAL CABLE INFORMATION▲.....	6
1.4 DESCRIPTION OF TEST CONFIGURATION	7
1.4.2 Support Equipment List and Details.....	7
1.4.3 Support Cable List and Details.....	7
1.5 MEASUREMENT UNCERTAINTY	8
2. SUMMARY OF TEST RESULTS	9
3. REQUIREMENTS AND TEST PROCEDURES	10
3.1 AUTHORIZED FREQUENCY BAND VERIFICATION	10
Applicable Standard	10
Test Procedure.....	10
3.2 MAXIMUM POWER MEASUREMENT	11
Applicable Standard	11
Test Procedure.....	11
3.3 MAXIMUM BOOSTER GAIN COMPUTATION.....	12
Applicable Standard	12
Test Procedure.....	12
3.4 INTERMODULATION PRODUCT	13
Applicable Standard	13
Test Procedure.....	13
3.5 OUT OF BAND EMISSIONS.....	14
Applicable Standard	14
Test Procedure.....	14
3.6 SPURIOUS EMISSIONS AT ANTENNA TERMINALS.....	15
Applicable Standard	15
Test Procedure.....	16
4. TEST DATA AND RESULTS.....	18
4.1 TEST ENVIRONMENTAL CONDITIONS & TEST EQUIPMENT LIST AND DETAILS.....	18
4.1.1 RF Conducted Test.....	18
4.2 AUTHORIZED FREQUENCY BAND VERIFICATION	19
4.3 MAXIMUM POWER MEASUREMENT.....	20
4.4 MAXIMUM BOOSTER GAIN COMPUTATION.....	22
4.5 INTERMODULATION PRODUCT	23
4.6 OUT OF BAND EMISSIONS.....	25
4.7 SPURIOUS EMISSIONS AT ANTENNA TERMINALS.....	36
5. RF EXPOSURE EVALUATION	40
5.1 APPLICABLE STANDARD	40
5.2 MPE Calculation	40
5.3 Calculated Result.....	40

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	DG8210506-15264E-00A	Original Report	2021-07-16
0	DG8210506-15264E-00	Original Report	2021-07-16
1	PCR220822001-00A	Revised Report	2022-09-05

Note:

1. In this report, the test results of the EUT's uplink output power test results and related test items in the original report (NO.: DG8210506-15264E-00A) have been corrected;
2. In this report, the uplink test results of the test items as shown in the table below supersede the corresponding test data in the original report (NO.: DG8210506-15264E-00A);
3. In this report, the uplink MPE calculation result supersede the corresponding data in the original report (NO.: DG8210506-15264E-00);

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

Product Name:	Signal Booster
Test Model:	SR15652001A
Multiple Models:	SR15652001B, SR15652001C, SR15652001D, SR15652001E
Model Difference:	Refer to the DOS
Rated Input Voltage:	DC 12V from adapter
Serial Number:	PCR220822001 -S1
EUT Received Date:	2022.08.22
EUT Received Status:	Good
Note: The Multiple Models are electrically identical with the test model. Please refer to the declaration letter for more detail, which was provided by manufacturer.	

1.2 Technical Specification

Operation Frequency Range(MHz)	Uplink:	Lower 700: 698-716 Upper 700: 776-787 Cellular: 824-849 AWS-1: 1710-1755 PCS: 1850-1915
	Downlink:	Lower 700: 728-746 Upper 700: 746-757 Cellular: 869-894 AWS-1: 2110-2155 PCS: 1930-1995
Max. RF Output Power (ERP/EIRP) (dBm):	Uplink:	24.16
	Downlink:	10.16

1.3 Antenna & Coaxial Cable Information ▲

Component	Type specification	Gain/Loss					Manufacturer
		LTE-707	LTE-781	800MHz	1900MHz	1700MHz\2100MHz	
Outside Cable	RG6FF 90Feet	4.3dB	4.6dB	5dB	7.6dB	6.6dB\8.4dB	Suirongcable
Outside Cable	SRLMR400-75NN 75Feet	4.2dB	4.2dB	4.4dB	6.1dB	5.8dB\6.5dB	Suirongcable
Outside Cable	RG6FF 75Feet	3.6dB	3.8dB	4.2dB	6.3dB	5.5dB\7dB	Suirongcable
Outside Cable	LMR240 75Feet	4.88dB	5.25dB	5.63dB	8.25dB	8.25\8.63dB	Suirongcable
Outside Cable	RG6FF 60Feet	2.9dB	3.0dB	3.3dB	5dB	4.4dB\5.6dB	Suirongcable
Outside Antenna	ANT050701	7dBi	7dBi	7dBi	10dBi	10dBi\10dBi	Shenzhen Dachi Communications Co., Ltd.
Outside Antenna	ANT010901	9dBi	9dBi	9dBi	9dBi	9dBi	Shenzhen Dachi Communications Co., Ltd.
Outside Antenna	ANT010701	9dBi	9dBi	9dBi	9dBi	9dBi	Shenzhen Dachi Communications Co., Ltd.
Outside Antenna	ANT060302	3dBi	3dBi	3dBi	3.5dBi	3.5dBi\3.5dBi	Shenzhen Dachi Communications Co., Ltd.
Outside Antenna	ANT030301	3dBi	3dBi	3dBi	3dBi	3dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Wall mounted Antenna	ANT050701	7dBi	7dBi	7dBi	10dBi	10dBi\10dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Wall mounted Antenna	ANT010901	9dBi	9dBi	9dBi	9dBi	9dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Wall mounted Antenna	ANT010701	9dBi	9dBi	9dBi	9dBi	9dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Wall mounted Antenna	ANT060302	3dBi	3dBi	3dBi	3.5dBi	3.5dBi\3.5dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Ceiling mounted Antenna	ANT040301	3dBi	3dBi	3dBi	3dBi	3dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Ceiling mounted Antenna	ANT080301	3dBi	3dBi	3dBi	3dBi	3dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Table top Antenna	ANT080302	3dBi	3dBi	3dBi	3dBi	3dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Table top Antenna	ANT080303	3dBi	3dBi	3dBi	3dBi	3dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Table top Antenna	ANT060301	3dBi	3dBi	3dBi	3dBi	3dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Table top Antenna	ANT060303	3dBi	3dBi	3dBi	3dBi	3dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Table top Antenna	ANT070101	1dBi	1dBi	1dBi	1dBi	1dBi	Shenzhen Dachi Communications Co., Ltd.
Inside Table top Antenna	SR-21300100	3dBi	3dBi	3dBi	3.5dBi	3.5dBi\3.5dBi	Shenzhen Dachi Communications Co., Ltd.

All equivalent antennas and cables are suitable for use with the SolidRF booster.

Note:

1. Antenna and coaxial cable information are provide from manufacturer, please refer to the Antenna Kitting Information in the User Manual.

2. Default combination declared by manufacturer:

SR15652001A + ANT050701 + RG6FF 75Feet + ANT080301

1.4 Description of Test Configuration

1.4.1 EUT Operation Condition:

EUT Operation Mode:	The system was configured for testing in Engineering Mode, which was provided by the manufacturer▲.
Equipment Modifications:	No
EUT Exercise Software:	No

1.4.2 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Fenfei Election	Termination	N-J-10W	/
Agilent	MXG Vector Signal Generator	N5182B	MY51350144

1.4.3 Support Cable List and Details

Cable Description	Shielding Cable	Ferrite Core	Length (m)	From Port	To
Coaxial Cable	Yes	No	2	MXG Vector Signal Generator	EUT
Coaxial Cable	Yes	No	0.5	EUT	Termination
Adapter Line	No	No	1	Adapter	EUT

1.5 Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	$\pm 5\%$
RF output power, conducted	$\pm 0.61\text{dB}$
Unwanted Emissions, radiated	30M~200MHz: 4.15 dB, 200M~1GHz: 5.61 dB, 1G~6GHz: 5.14 dB, 6G~18GHz: 5.93 dB, 18G~26.5G: 5.47 dB, 26.5G~40G: 5.63 dB
Unwanted Emissions, conducted	$\pm 1.26\text{dB}$
Temperature	$\pm 1^\circ\text{C}$
Humidity	$\pm 5\%$

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

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§ 20.21(e)(3)	7.1 Authorized Frequency Band Verification	Compliance*
§ 20.21(e)(8)(i)(D) § 20.21(e)(8)(i)(B) § 20.21(e)(4)	7.2 Maximum Power Measurement	Compliance*
§ 20.21(e)(8)(i)(C)(2) § 20.21(e)(8)(i)(B) § 20.21(e)(4)	7.3 Maximum Booster Gain Computation	Compliance*
§ 20.21(e)(8)(i)(F)	7.4 Intermodulation Product	Compliance*
§ 20.21(e)(8)(i)(E)	7.5 Out Of Band Emissions	Compliance*
§ 2.1051	7.6 Spurious Emissions At Antenna Terminals	Compliance*
§ 20.21(e)(8)(i)(A) § 20.21(e)(8)(i)(H) § 20.21(e)(4)	7.7 Noise Limits	Compliance**
§ 20.21(e)(8)(i)(I) § 20.21(e)(4)	7.8 Uplink Inactivity	Compliance**
§ 20.21(e)(8)(i)(C)(1) § 20.21(e)(8)(i)(H)	7.9 Variable Booster Gain	Compliance**
§ 2.1049	7.10 Occupied Bandwidth	Compliance**
§ 20.21(e)(8)(ii)(A) § 20.21(e)(5)	7.11 Oscillation Detection	Compliance**
§ 2.1053	7.12 Radiated Spurious Emissions	Compliance**
§ 20.21(e)(8)(i)(B) § 20.21(e)(3)	7.13 Spectrum block filtering test procedure	Not applicable

Note:

Compliance*: For Downlink test data please refer to Original Report NO.: DG8210506-15264E-00A.

Compliance**: Test data please refer to Original Report NO.: DG8210506-15264E-00A.

Not applicable: This item only for wideband consumer boosters using spectrum block filtering.

3. REQUIREMENTS AND TEST PROCEDURES

3.1 Authorized Frequency Band Verification

Applicable Standard

According to § 20.21(e)(3) *Frequency Bands*.

This test is intended to confirm that the signal booster only operates on the CMRS frequency bands authorized for use by the NPS. In other words, the signal booster shall reject amplification of other signals outside of its passband. In addition, this test will identify the frequency at which the maximum gain is realized within each CMRS operational band, which then serves as a basis for subsequent tests.

Test Procedure

- a) Connect the EUT to the test equipment as shown in **Figure 1**. Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Set the spectrum analyzer resolution bandwidth (RBW) for 100 kHz with the video bandwidth (VBW) ≥ 3 the RBW, using a PEAK detector with the MAX HOLD function.
- c) Set the center frequency of the spectrum analyzer to the center of the operational band under test with a span of 1 MHz.
- d) Set the signal generator for CW mode and tune to the center frequency of the operational band under test.
- e) Set the initial signal generator power to a level that is at least 6 dB below the AGC level specified by the manufacturer.
- f) Slowly increase the signal generator power level until the output signal reaches the AGC operational level.
- g) Reduce the signal generator power to a level that is 3 dB below the level noted above, then manually reset the EUT (e.g., cycle ac/dc power).
- h) Reset the spectrum analyzer span to 2 the width of the CMRS band under test. Adjust the tuned frequency of the signal generator to sweep 2 the width of the CMRS band using the sweep function. The AGC must be deactivated throughout the entire sweep.
- i) Using three markers, identify the CMRS band edges and the frequency with the highest power. Affirm that the values of all markers are visible on the display of the spectrum analyzer (e.g., marker table set to on).
- j) Capture the spectrum analyzer trace for inclusion in the test report.
- k) Repeat 7.1c) to 7.1j) for all operational uplink and downlink bands.

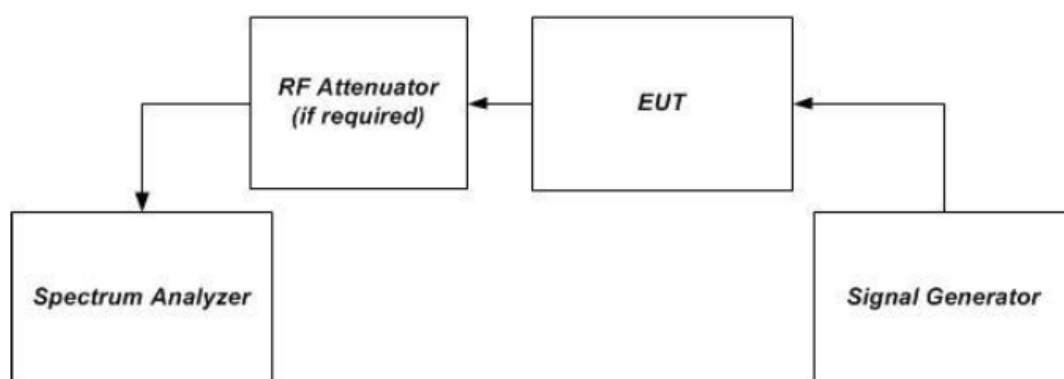


Figure 1 – Band verification test instrumentation setup

3.2 Maximum Power Measurement

Applicable Standard

According to § 20.21(e)(8)(i)(D) *Power Limits*; § 20.21(e)(8)(i)(B) *Bidirectional Capability* (uplink minimum conducted power output); § 20.21(e)(4) *Self-monitoring*.

This procedure shall be used to demonstrate compliance to the signal booster power limits and requirements as specified in Sections 20.21(e)(8)(i)(D) and 20.21(e)(8)(i)(B) for wideband consumer signal boosters.

- a) Compliance to applicable EIRP limits must be shown using the highest gains from the list of antennas, cabling, and coupling devices declared by the manufacturer for use with the consumer booster.
- b) In addition, the maximum power levels measured in this procedure will be used in calculating the maximum gain as described in the next subclause.
- c) The frequency with the highest power level in each operational band as determined in 7.1 is to be measured discretely by applying the following procedure using the stated emission and power detector types independently.
- d) Use a signal generator to create a pulsed CW or GSM signal with a pulse width of 570 μ s and a duty cycle of 12.5% (i.e., one GSM timeslot), then measure using the burst power function of the measuring instrument.
- e) Use a signal generator to create an AWGN signal with a 99% occupied bandwidth (OBW) of 4.1 MHz, then measure using the channel power or band power function of the measuring instrumentation.
- f) All modes of operation must be verified to maintain operation within applicable limits at the maximum uplink and downlink test levels per device type as defined in 5.5, by increasing the power level in 2 dB steps from the AGC level to the maximum input level specified in 5.5.

Test Procedure

- a) Connect the EUT to the test equipment as shown in **Figure 1**. Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Configure the signal generator and spectrum analyzer for operation on the frequency determined in 7.1 with the highest power level, but with the center frequency of the signal no closer than 2.5 MHz from the band edge. The spectrum analyzer span shall be set to at least 10 MHz.
- c) Set the initial signal generator power to a level well below that which causes AGC activation.
- d) Slowly increase the signal generator power level until the output signal reaches the AGC operational limit (from observation of signal behavior on the spectrum analyzer; i.e., no further increase in output power as input power is increased).
- e) Reduce power sufficiently on the signal generator to ensure that the AGC is not controlling the power output.
- f) Slowly increase the signal generator power to a level just below (and within 0.5 dB of) the AGC limit without triggering the AGC. Note the signal generator power level as P_{in} .
- g) Measure the output power, P_{out} , with the spectrum analyzer as follows.
 - 1) Set RBW = 100 kHz for AWGN signal type, or 300 kHz for CW or GSM signal type.
 - 2) Set VBW $\geq 3 \times$ RBW.
 - 3) Select either the BURST POWER or CHANNEL POWER measurement mode, as required for each signal type. For AWGN, the channel power integration bandwidth shall be the 99% OBW of the 4.1 MHz signal.
 - 4) Select the power averaging (rms) detector.
 - 5) Affirm that the number of measurement points per sweep $\geq (2 \times \text{span})/\text{RBW}$.
NOTE—This requirement does not apply for BURST power measurement mode.
 - 6) Set sweep time = auto couple, or as necessary (but no less than auto couple value).
 - 7) Trace average at least 100 traces in power averaging (i.e., rms) mode.
 - 8) Record the measured power level P_{out} , with one set of results for the GSM or CW input stimulus, and another set of results for the AWGN input stimulus.
- h) Repeat step g) while increasing the signal generator amplitude in 2 dB steps until the maximum input level indicated in 5.5 is reached. If the booster has shut down at any point during the input power steps, it should be noted and step g) shall be repeated at an input level 1 dB less than that found to cause the shutdown. The test report shall include either a statement describing that the device complies at 10 dB above AGC or at the 5.5 power levels, or a table showing compliance at the additional input power(s) required.

- i) Repeat the entire procedure for each operational uplink and downlink frequency band supported by the booster.
- j) Provide tabulated results in the test report.

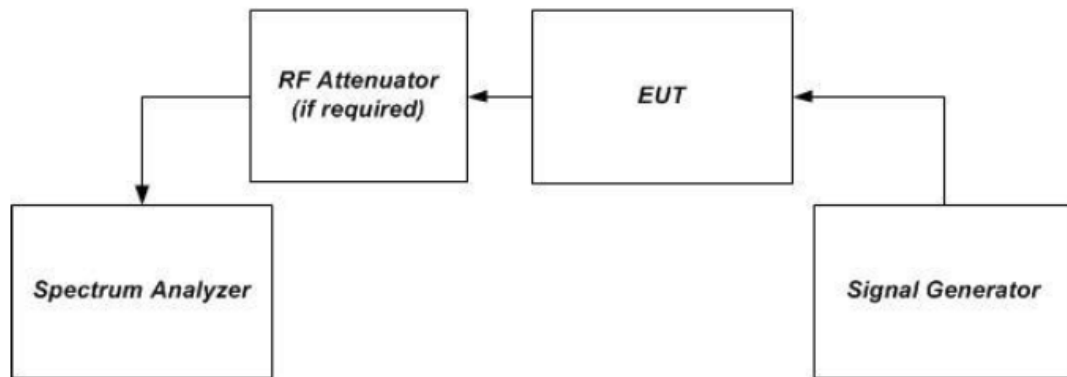


Figure 1 – Band verification test instrumentation setup

3.3 Maximum Booster Gain Computation

Applicable Standard

According to § 20.21(e)(8)(i)(C)(2) *Booster Gain Limits* (maximum gain); § 20.21(e)(8)(i)(B) *Bidirectional Capability* (equivalent uplink and downlink gain); § 20.21(e)(4) *Self-monitoring*.

This subclause provides guidance for the calculation of the maximum gain, based on the results obtained from the 7.1 and 7.2 measurements. The NPS limits on maximum gain for fixed and mobile wideband consumer signal boosters are provided in Section 20.21(e)(8)(i)(C)(2). Additionally, Section 20.21(e)(8)(i)(B) requires that wideband consumer signal boosters be able to provide equivalent uplink and downlink gain, i.e., within 9 dB.

Test Procedure

- a) Calculate the maximum gain of the booster as follows to demonstrate compliance to the applicable gain limits as specified.
- b) For both the uplink and downlink in each supported frequency band, use each of the P_{OUT} and P_{IN} result pairs for all signal types used in 7.2 in the following equation to obtain the maximum gain, G:

$$G \text{ (dB)} = P_{OUT} \text{ (dBm)} - P_{IN} \text{ (dBm)}.$$
- c) Record the maximum gain of the uplink and downlink paths for each supported frequency band, and verify that the each gain value complies with the applicable limit.
- d) Provide tabulated results in the test report.

3.4 Intermodulation Product

Applicable Standard

According to § 20.21(e)(8)(i)(F) *Intermodulation Limits*.

The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of -19 dBm for the supported bands of operation. Compliance with intermodulation limits will use boosters operating at maximum gain and maximum rated output power, with two continuous wave (CW) input signals spaced 600 kHz apart and centered in the pass band of the booster, and with a 3 kHz measurement bandwidth.

Test Procedure

The following procedures shall be used to demonstrate compliance to the intermodulation limit specified in Section 20.21(e)(8)(i)(F) for wideband consumer signal boosters.

- a) Connect the signal booster to the test equipment as shown in **Figure 2**. Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Set the spectrum analyzer RBW = 3 kHz.
- c) Set the VBW $\geq 3 \times$ RBW.
- d) Select the rms detector.
- e) Set the spectrum analyzer center frequency to the center of the supported operational band under test.
- f) Set the span to 5 MHz. Affirm that the number of measurement points per sweep $\geq (2 \times \text{span})/\text{RBW}$.
- g) Configure the two signal generators for CW operation with generator #1 tuned 300 kHz below the operational band center frequency and generator #2 tuned 300 kHz above the operational band center frequency. If the maximum output power is not at the operational-band (booster pass band) center frequency, configure the test signal pair around the frequency with maximum output power as determined per 7.2.
- h) Set the signal generator amplitudes so that the power from each into the EUT is equivalent, then turn on the RF output.
- i) Simultaneously increase each signal generators' amplitude equally until just before the EUT begins AGC, then affirm that all intermodulation-product emissions (if any occur) are below the specified limit of -19 dBm.
- j) Use the trace averaging function of the spectrum analyzer, and wait for the trace to stabilize. Place a marker at the highest amplitude intermodulation-product emission.
- k) Record the maximum intermodulation product amplitude level that is observed.
- l) Capture the spectrum analyzer trace for inclusion in the test report.
- m) Repeat 7.4e) to 7.4l) for all uplink and downlink operational bands.

NOTE—If using a single signal generator with dual outputs, affirm that intermodulation products are not the result of the generator.

- n) Increase the signal generator amplitude in 2 dB steps to 10 dB above the AGC threshold determined in 7.4i), but not exceeding the maximum input level of 5.5, to affirm that the EUT maintains compliance with the intermodulation limit. The test report shall include either a statement describing that the device complies at 10 dB above AGC or at the 5.5 power levels, or a table showing compliance at the additional input power(s) required.

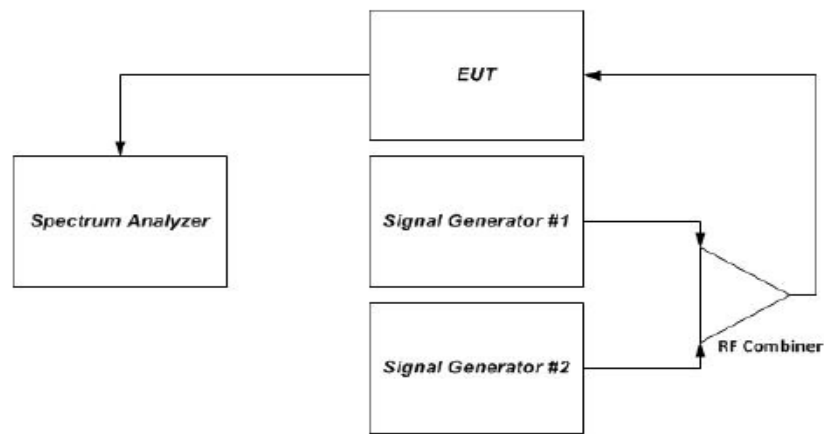


Figure 2 – Intermodulation product instrumentation test setup

3.5 Out Of Band Emissions

Applicable Standard

According to § 20.21(e)(8)(i)(E) *Out of Band Emission Limits*.

Test Procedure

This measurement is intended to demonstrate compliance to the limit specified in Section 20.21(e)(8)(i)(E). The mobile-station emission limit is listed in Appendix A for each applicable operating band and rule part.

- a) Connect the EUT to the test equipment as shown in **Figure 1**. Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Configure the signal generator for the appropriate operation for all uplink and downlink bands:
 - 1) GSM: 0.2 MHz from upper and lower band edges.
 - 2) LTE (5 MHz): 2.5 MHz from upper and lower band edges.
 - 3) CDMA: 1.25 MHz from upper and lower band edges, except for cellular band as follows (only the upper and lower frequencies need to be tested):
824.88 MHz, 845.73 MHz, 836.52 MHz, 848.10 MHz,
869.88 MHz, 890.73 MHz, 881.52 MHz, 893.10 MHz.

NOTE 1–Alternative test modulation types:

- CDMA (alternative 1.25 MHz AWGN)
- LTE 5 MHz (alternative W-CDMA or 4.1 MHz AWGN)

NOTE 2–For LTE, the signal generator should use the uplink and downlink signal types for these modulations in uplink and downlink tests, respectively. LTE shall use 5 MHz signal, 25 resource blocks transmitting.

NOTE 3–When using an AWGN test signal, the bandwidth shall be the measured 99% OBW.

- c) Set the signal generator amplitude to the maximum power level prior to AGC similar to 7.2.2e) to 7.2.2f) of the power measurement procedures for the appropriate modulations.
- d) Set RBW = measurement bandwidth specified in the applicable rule section for the supported frequency band (see Appendix A for cross-reference to applicable rule section).
NOTE 3–Within 300 kHz and 3 MHz away from band edge, if smaller RBW is used (i.e., RBW < 100 kHz or 1 MHz, for above and below 1 GHz, respectively), per Parts 24 and 27 the smaller RBW is applicable only for frequencies within 100 kHz or 1 MHz (for above and below 1 GHz, respectively) away from the band edge.
- e) Set VBW = 3* RBW.
- f) Select the power averaging (rms) detector.
- g) Sweep time = auto-couple.

- h) Set the analyzer start frequency to the upper band/block edge frequency and the stop frequency to the upper band/block edge frequency plus: 300 kHz (when operational frequency is < 1 GHz), or 3 MHz (when operational frequency is ≥ 1 GHz).
- i) Trace average at least 100 traces in power averaging (i.e., rms) mode.
- j) Use peak marker function to find the maximum power level.
- k) Capture the spectrum analyzer trace of the power level for inclusion in the test report.
- l) Increase the signal generator amplitude in 2 dB steps until the maximum input level per 5.5 is reached. Affirm that the EUT maintains compliance with the OOB limits. The test report shall include either a statement describing that the device complies at 10 dB above AGC or at the 5.5 power levels, or a table showing compliance at the additional input power(s) required.
- m) Reset the analyzer start frequency to the lower band/block edge frequency minus: 300 kHz (when operational frequency is < 1 GHz), or 3 MHz (when operational frequency is ≥ 1 GHz), and the stop frequency to the lower band/block edge frequency, then repeat 7.5i) to 7.5l).
- n) Repeat 7.5b) through 7.5m) for each uplink and downlink operational band.

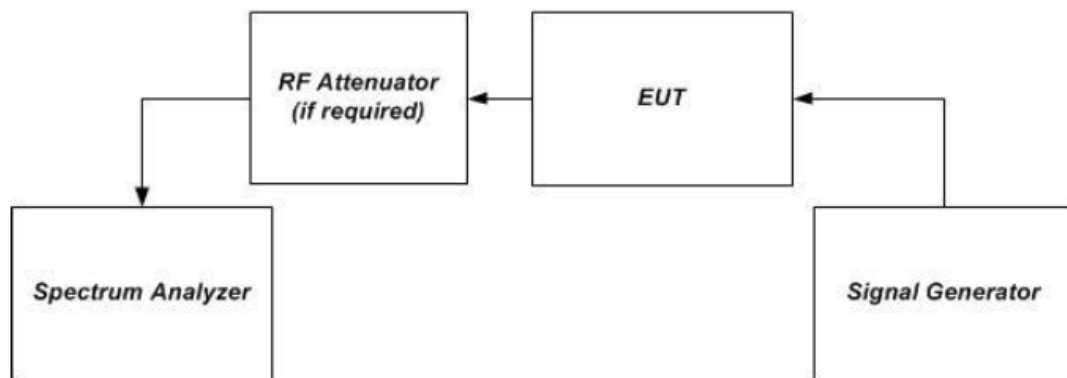


Figure 1 – Band verification test instrumentation setup

3.6 Spurious Emissions At Antenna Terminals

Applicable Standard

According to §2.1051 *Measurements required: Spurious emissions at antenna terminals.*

§20.21(e)(8)(i)(E): Booster out of band emissions (OOBE) shall be at least 6 dB below the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

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

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

§27.53: the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;

Test Procedure

The following procedures shall be used to demonstrate compliance to the applicable conducted spurious emissions limits as per Section 2.1051.

NOTE—For frequencies below 1 GHz, an RBW of 1 MHz may be used in a preliminary measurement. If non-compliant emissions are detected, a final measurement shall be made with a 100 kHz RBW. Additionally, a peak detector may also be used for the preliminary measurement. If non-compliant emissions are detected then a final measurement of these emissions shall be made with the power averaging (rms) detector.

- a) Connect the EUT to the test equipment as shown in **Figure 1**. Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Configure the signal generator for AWGN with a 99% OBW of 4.1 MHz, with a center frequency corresponding to the center of the CMRS band under test.
- c) Set the signal generator amplitude to the level determined in the power measurement procedure in 7.2.
- d) Turn on the signal generator RF output and measure the spurious emission power levels with an appropriate measuring instrument as follows.
 - 1) Set RBW = measurement bandwidth specified in the applicable rule section for the operational frequency band under consideration (see Appendix A for relevant cross-references). Note that many of the individual rule sections permit the use of a narrower RBW [typically $\geq 1\%$ of the emission bandwidth (EBW)] to enhance measurement accuracy, but the result must then be integrated over the specified measurement bandwidth.
 - 2) Set VBW = 3* RBW.
 - 3) Select the power averaging (rms) detector. (See above note regarding the use of a peak detector for preliminary measurements.)
 - 4) Sweep time = auto-couple.
 - 5) Set the analyzer start frequency to the lowest radio frequency signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part. Note that the number of measurement points in each sweep must be $\geq (2 \text{ span/RBW})$, which may require that the measurement range defined by the preceding start and stop frequencies be subdivided, depending on the available number of measurement points of the spectrum analyzer. Trace average at least 10 traces in power averaging (i.e., rms) mode.
 - 6) Sweep time = auto-couple.
 - 7) Use the peak marker function to identify the highest amplitude level over each measured frequency range. Record the frequency and amplitude and capture a plot for inclusion in the test report.
 - 8) Reset the analyzer start frequency to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part, and the analyzer stop frequency to 10 times the highest frequency of the fundamental emission. Note that the number of measurement points in each sweep must be $\geq (2 \text{ * span/RBW})$ which may require that the measurement range defined by the start and stop frequencies above be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.
 - 9) Use the peak marker function to identify the highest amplitude level over each of the measured frequency ranges. Record the frequency and amplitude and capture a plot for inclusion in the test report.
- e) Repeat 7.6b) through 7.6d) for each supported frequency band of operation.

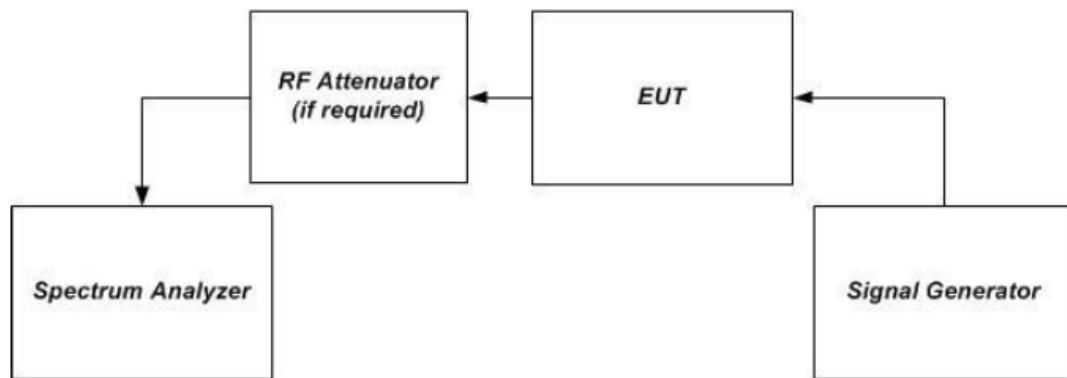


Figure 1 – Band verification test instrumentation setup

4. TEST DATA AND RESULTS

4.1 Test Environmental Conditions & Test Equipment List and Details

4.1.1 RF Conducted Test

Test Date:		2022-09-03~2022-09-05			
Tester:		Sern Shen			
Environmental Conditions:					
Temperature: (°C)	25~26.2	Relative Humidity: (%)	53~56	ATM Pressure: (kPa)	100.5~100.6

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101474	2022/7/15	2023/7/14
YINSAIGE	Coaxial Cable	SS402	SJ0100003	2022/8/7	2023/8/6
YINSAIGE	Coaxial Cable	SS402	SJ0100004	2022/8/7	2023/8/6
Mini-Circuits	DC Block	BLK-18-S+	1554404	2022/8/7	2023/8/6
Agilent	MXG Vector Signal Generator	N5182B	MY51350144	2022/7/15	2023/7/14
R&S	Wideband Radio Communication Tester	CMW500	149218	2022/7/15	2023/7/14

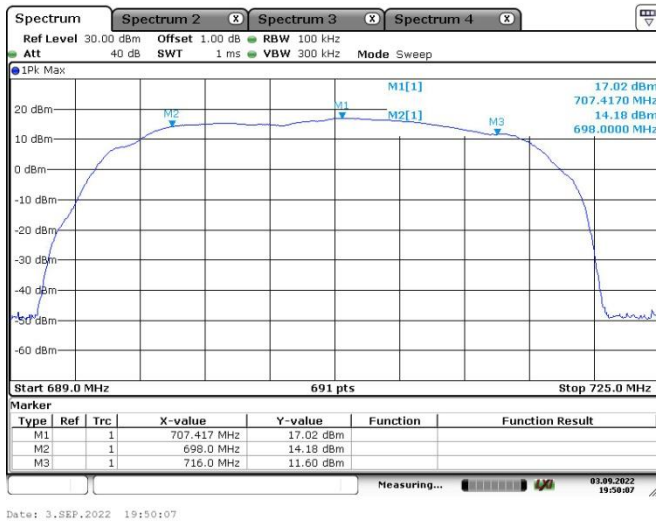
Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

4.2 Authorized Frequency Band Verification

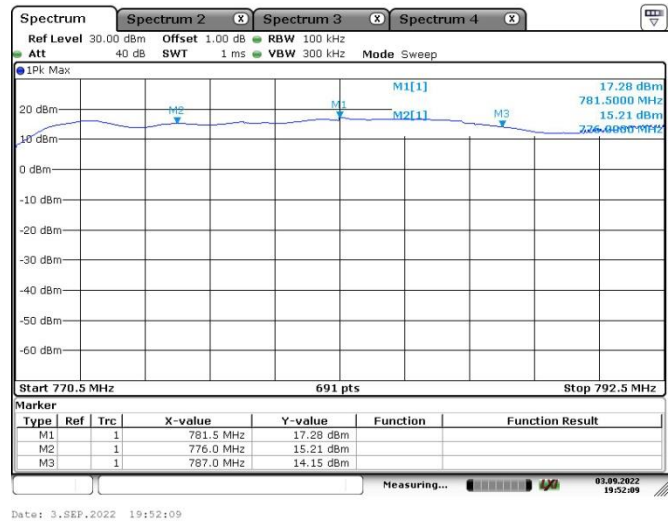
Test Result: Compliance. Please refer to following plots.

Note: 1. Uplink test result of this test item supersede the corresponding test data in the original report (NO.: DG8210506-15264E-00A);
2. For Downlink test data please refer to original report (NO.: DG8210506-15264E-00A);

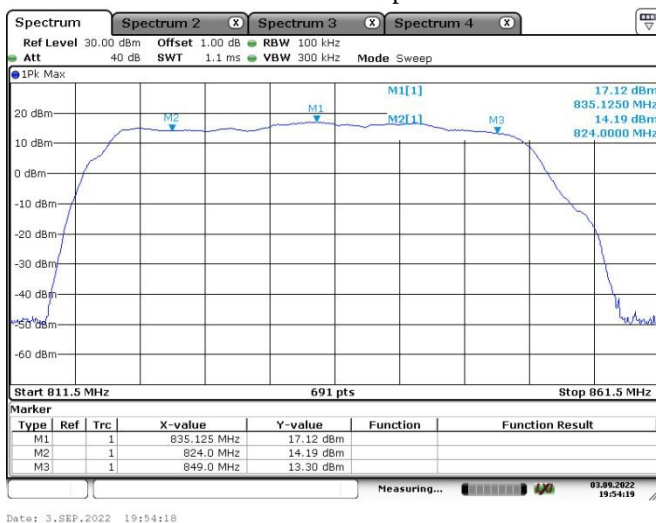
Lower 700MHz Band Uplink



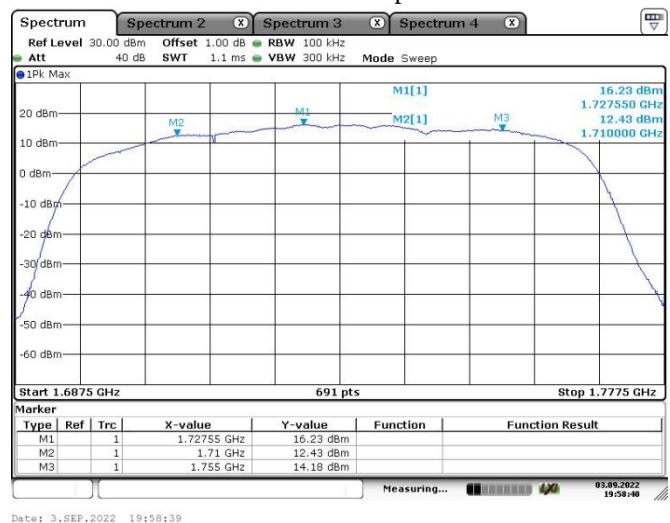
Upper 700MHz Band Uplink



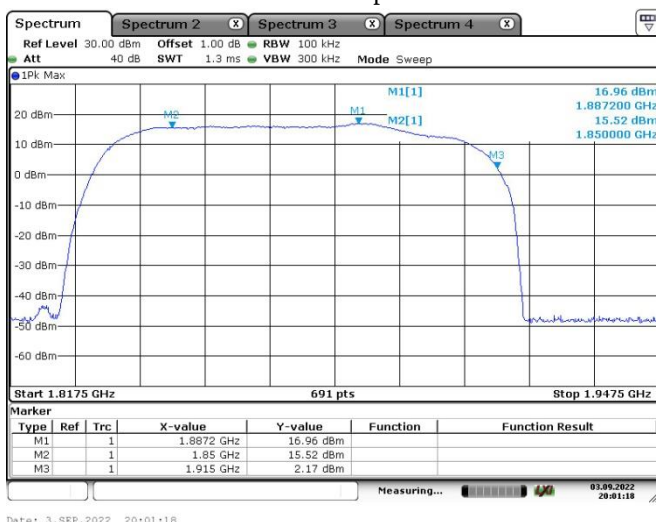
Cellular Band Uplink



AWS-1 Band Uplink



PCS Band Uplink



4.3 Maximum Power Measurement

Test Result: Compliance. Please refer to following tables.

Note:

1. Uplink test result of this test item supersede the corresponding test data in the original report (NO.: DG8210506-15264E-00A);
2. For Downlink test data please refer to original report (NO.: DG8210506-15264E-00A);

AGC Input Level:

Mode	Operation Band	Signal Type	Pre AGC Input Level
			dBm
Uplink	Lower 700MHz	AWGN	-34
		GSM	-35
	Upper 700MHz	AWGN	-32
		GSM	-33
	Cellular	AWGN	-32
		GSM	-35
	AWS-1	AWGN	-32
		GSM	-33
	PCS	AWGN	-35
		GSM	-36

Maximum Output Power:

Mode	Operation Band	Signal Type	Pre AGC Input Level	Conducted Output Power (dBm)		Antenna Gain	Cable Loss	EIRP	Limit
			dBm	Test Value	Limit				dBm
Uplink	Lower 700MHz	AWGN	-34	17.77	≥17	9	2.90	23.87	≤30
		GSM	-35	18.06		9	2.90	24.16	
	Upper 700MHz	AWGN	-32	17.90		9	3.00	23.90	
		GSM	-33	18.11		9	3.00	24.11	
	Cellular	AWGN	-32	17.69		9	3.30	23.39	
		GSM	-35	17.73		9	3.30	23.43	
	AWS-1	AWGN	-32	17.32		10	4.40	22.92	
		GSM	-33	17.22		10	4.40	22.82	
	PCS	AWGN	-35	17.61		10	5.00	22.61	
		GSM	-36	17.64		10	5.00	22.64	

Note:

Compliance to applicable EIRP limits used highest gains from the list of antennas, cabling, and coupling devices declared by the manufacturer for use with the consumer booster.

Maximum Input Level:

Mode	Operation Band	Signal Type	Maximum Input Level	Maximum Input Level Limits	Conducted Output Level
			dBm	dBm	dBm
Uplink	Lower 700MHz	AWGN	-22	≤ 27	17.83
		GSM	-22		17.77
	Upper 700MHz	AWGN	-21		17.64
		GSM	-21		17.73
	Cellular	AWGN	-22		18.15
		GSM	-22		18.07
	AWS-1	AWGN	-23		17.65
		GSM	-23		17.11
	PCS	AWGN	-24		17.36
		GSM	-24		17.38

4.4 Maximum Booster Gain Computation

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

Note:

1. Uplink test result of this test item supersede the corresponding test data in the original report (NO.: DG8210506-15264E-00A);
2. For Downlink test data please refer to original report (NO.: DG8210506-15264E-00A);

Maximum Gain:

Mode	Operation Band	Signal Type	Pre AGC Input level	Conducted Output level	Gain	Limit
			dBm	dBm	dB	dB
Uplink	Lower 700MHz	AWGN	-34	17.77	51.77	≤63.49
		GSM	-35	18.06	53.06	
	Upper 700MHz	AWGN	-32	17.90	49.90	≤64.36
		GSM	-33	18.11	51.11	
	Cellular	AWGN	-32	17.69	49.69	≤64.95
		GSM	-35	17.73	52.73	
	AWS-1	AWGN	-32	17.32	49.32	≤71.27
		GSM	-33	17.22	50.22	
	PCS	AWGN	-35	17.61	52.61	≤71.99
		GSM	-36	17.64	53.64	

Note: Fixed Booster maximum gain shall not exceed $6.5 \text{ dB} + 20 \text{ Log}_{10}(\text{Frequency})$, Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

Equivalent Uplink and Downlink Gain:

Operating Band	Signal type	Uplink Gain	Downlink Gain	Calculated Value	Limit
MHz		dB	dB	dB	dB
Lower 700MHz	AWGN	51.77	54.79	-3.02	±9
	GSM	53.06	59.16	-6.10	
Upper 700MHz	AWGN	49.90	54.09	-4.19	
	GSM	51.11	57.11	-6.00	
Cellular	AWGN	49.69	51.38	-1.69	
	GSM	52.73	54.1	-1.37	
AWS-1	AWGN	49.32	55.93	-6.61	
	GSM	50.22	57.47	-7.25	
PCS	AWGN	52.61	55.12	-2.51	
	GSM	53.64	56.66	-3.02	

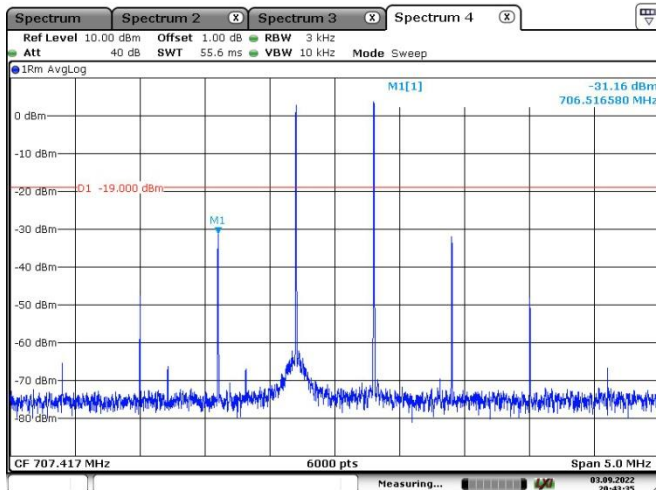
4.5 Intermodulation Product

Test Result: Compliance. Please refer to following plots.

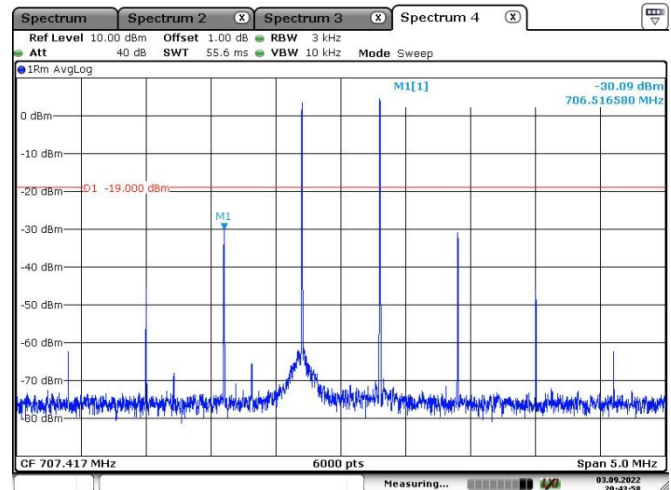
Note:

1. Uplink test result of this test item supersede the corresponding test data in the original report (NO.: DG8210506-15264E-00A);
2. For Downlink test data please refer to original report (NO.: DG8210506-15264E-00A);

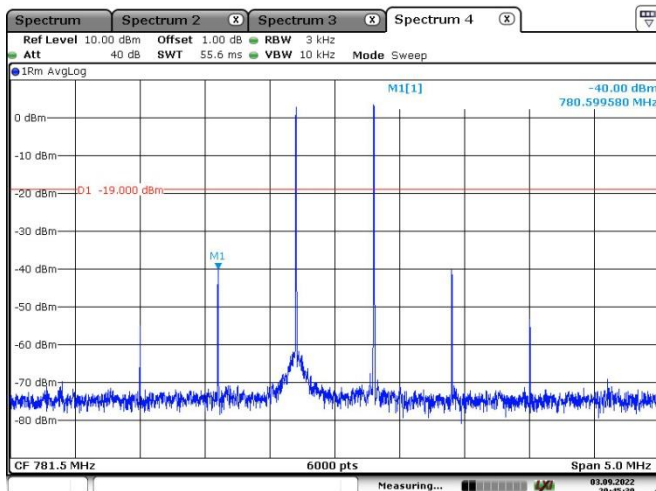
Lower 700MHz Band Uplink-Pre AGC



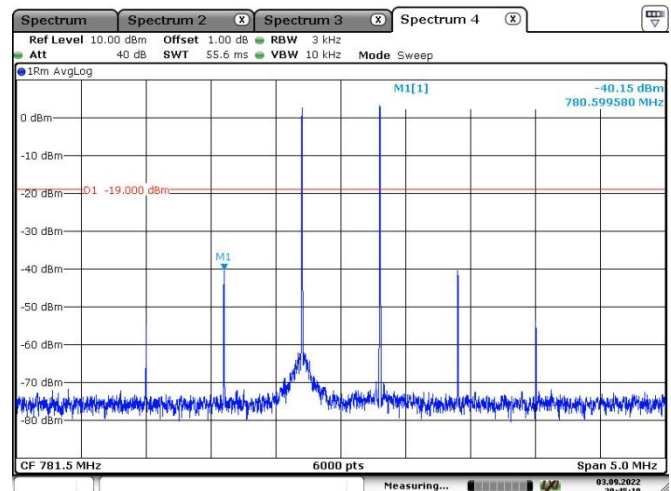
Lower 700MHz Band Uplink-Above AGC



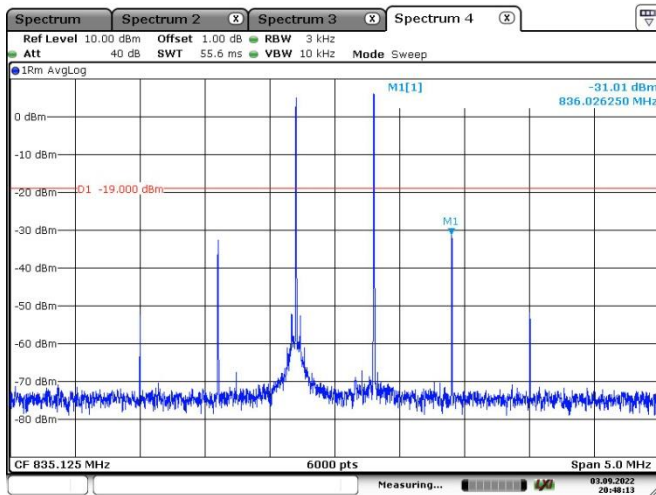
Upper 700MHz Band Uplink-Pre AGC



Upper 700MHz Band Uplink-Above AGC

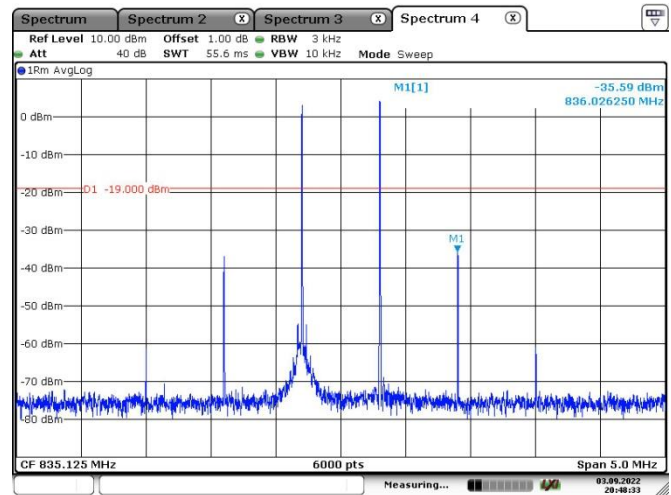


Cellular Band Uplink-Pre AGC



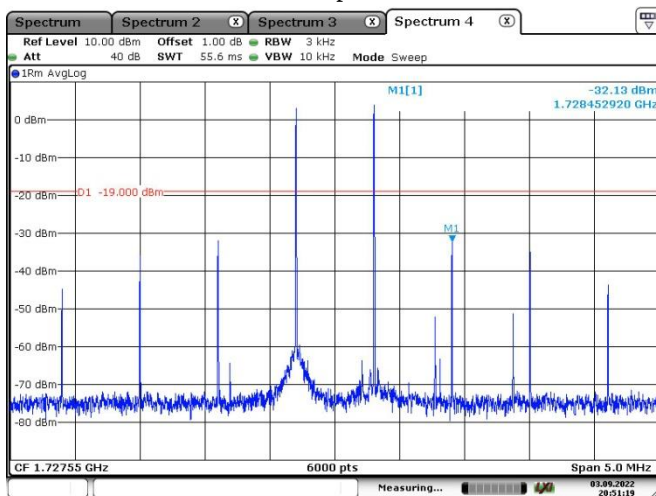
Date: 3.SEP.2022 20:48:13

Cellular Band Uplink-Above AGC



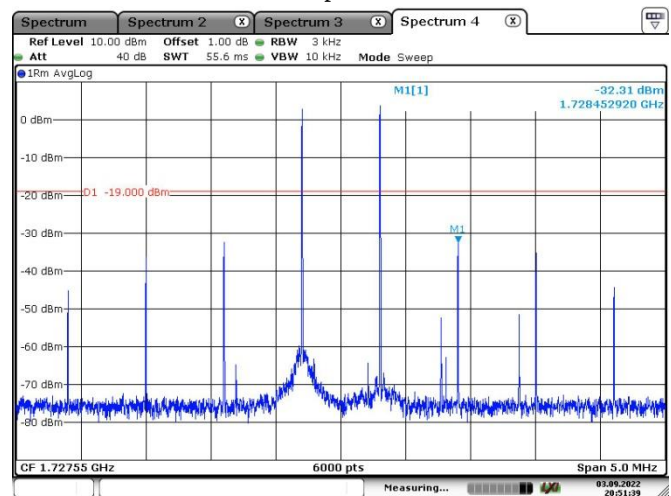
Date: 3.SEP.2022 20:48:33

AWS-1 Band Uplink-Pre AGC



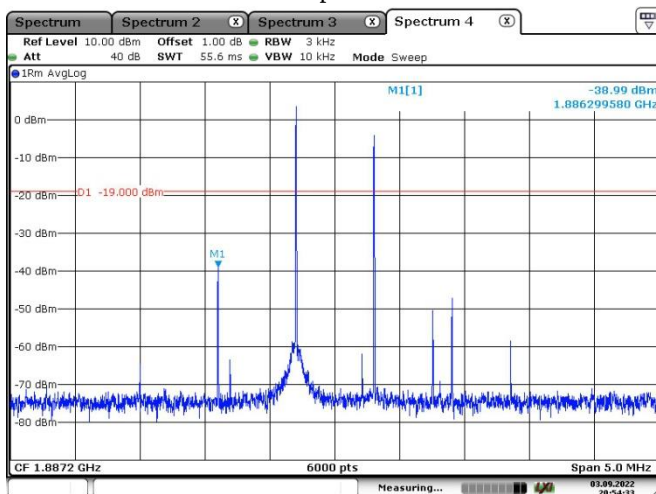
Date: 3.SEP.2022 20:51:19

AWS-1 Band Uplink-Above AGC



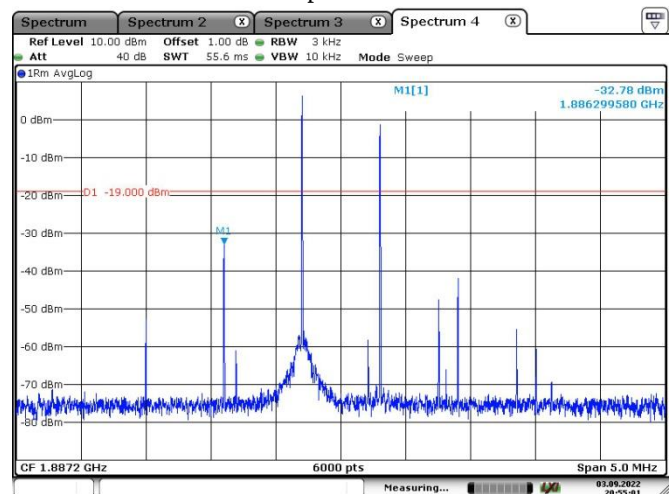
Date: 3.SEP.2022 20:51:39

PCS Band Uplink-Pre AGC



Date: 3.SEP.2022 20:54:33

PCS Band Uplink-Above AGC



Date: 3.SEP.2022 20:55:01

4.6 Out Of Band Emissions

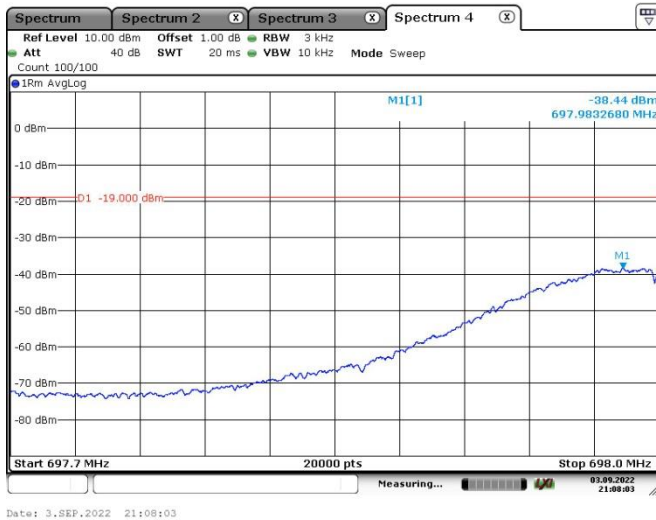
Test Result: Compliance. Please refer to following plots.

Note:

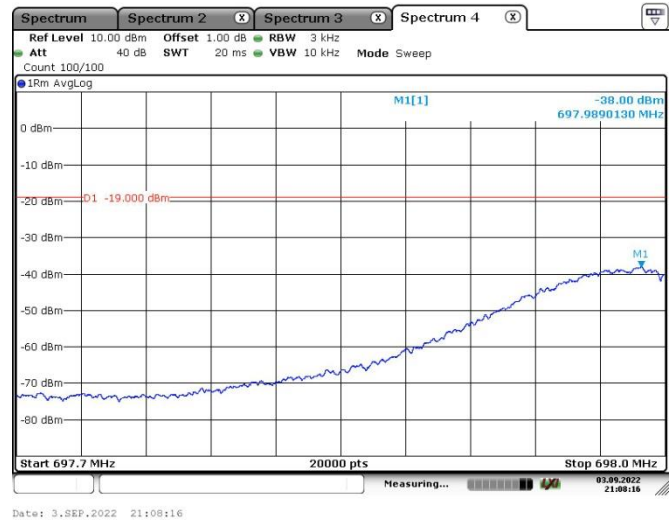
1. Uplink test result of this test item supersede the corresponding test data in the original report (NO.: DG8210506-15264E-00A);
2. For Downlink test data please refer to original report (NO.: DG8210506-15264E-00A);

Lower 700M Band Uplink

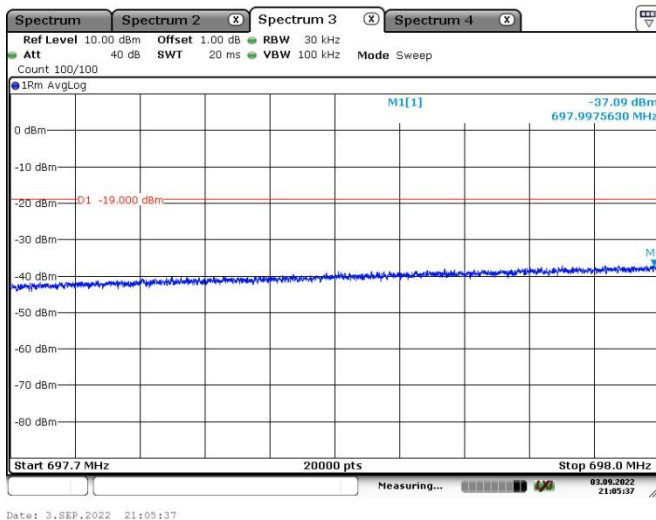
Left Side-GSM-Pre AGC



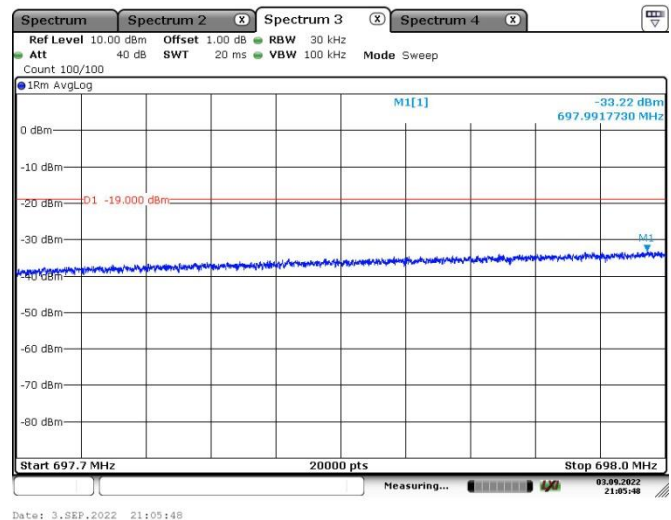
Left Side-GSM-Above AGC



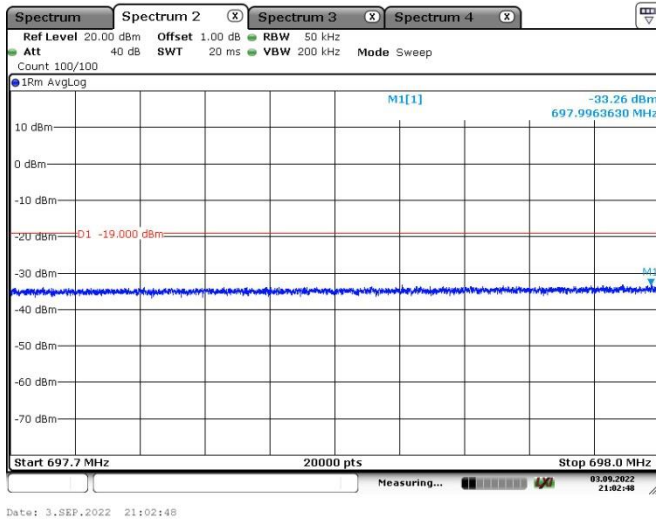
Left Side-CDMA-Pre AGC



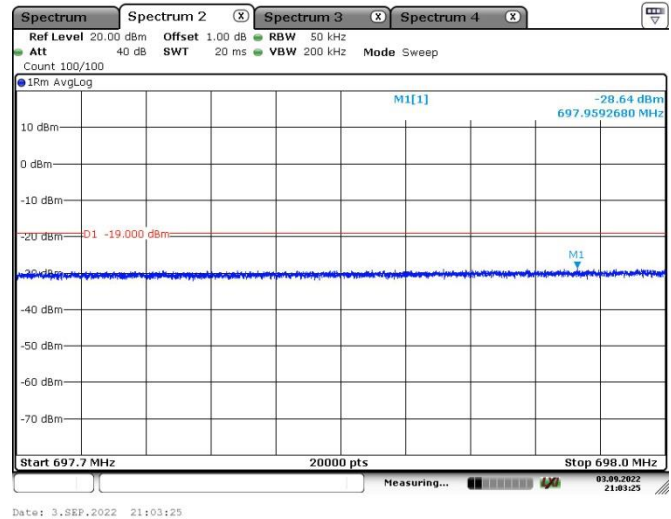
Left Side-CDMA-Above AGC



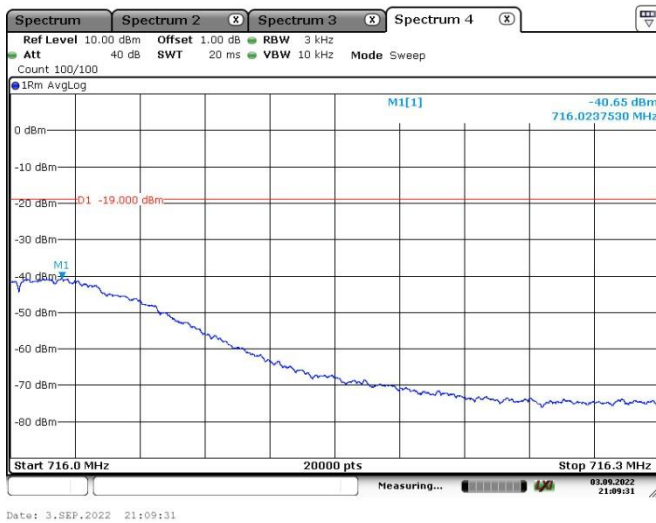
Left Side-WCDMA-Pre AGC



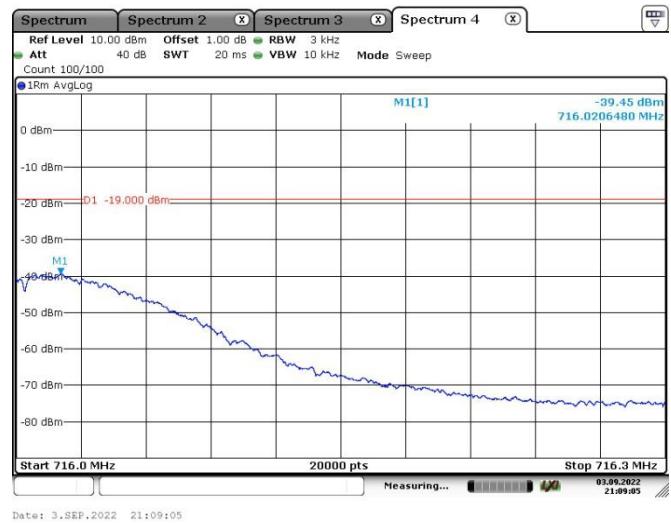
Left Side-WCDMA-Above AGC



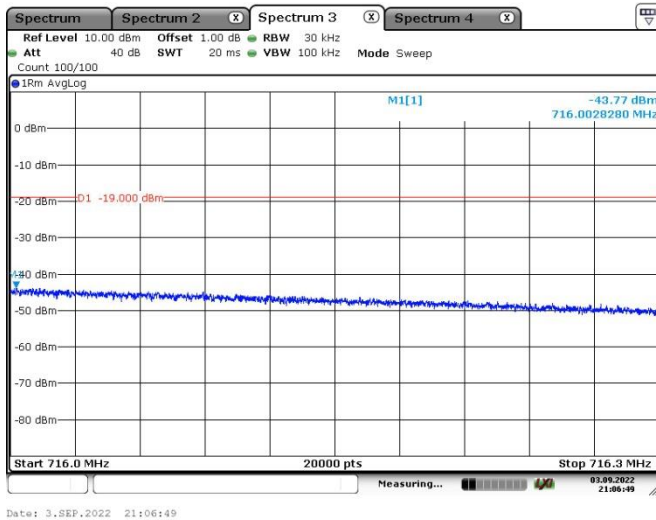
Right Side-GSM-Pre AGC



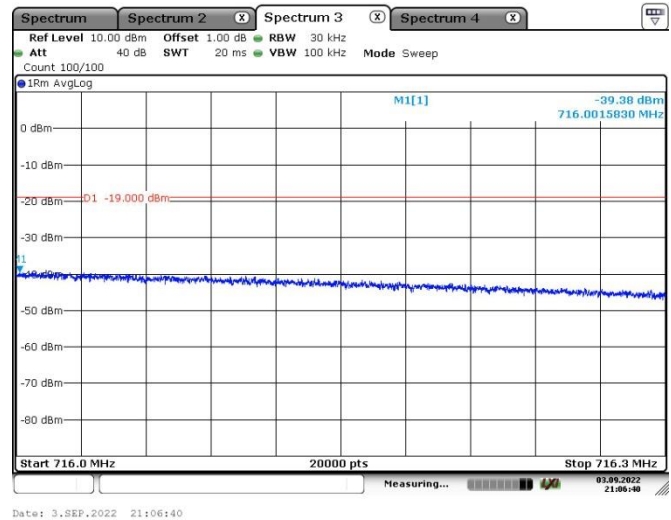
Right Side-GSM-Above AGC



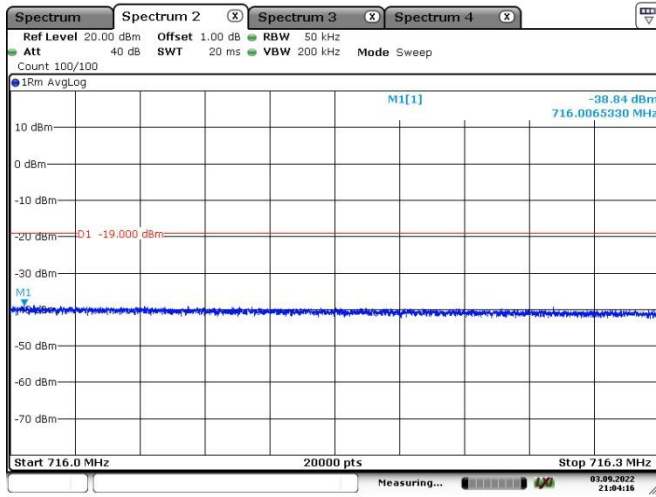
Right Side-CDMA-Pre AGC



Right Side-CDMA-Above AGC

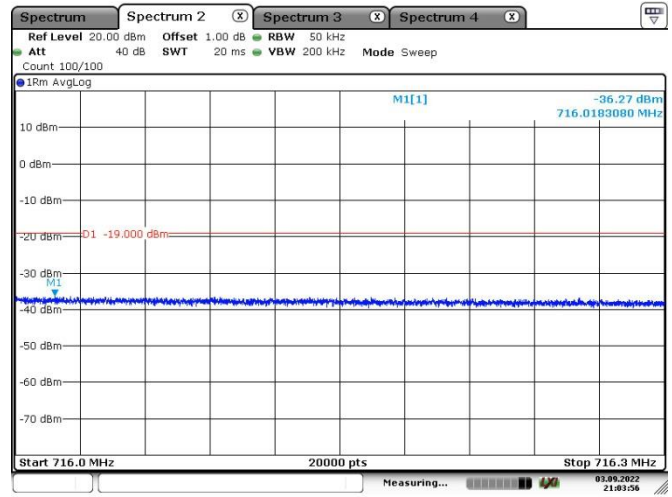


Right Side-WCDMA-Pre AGC



Date: 3.SEP.2022 21:04:16

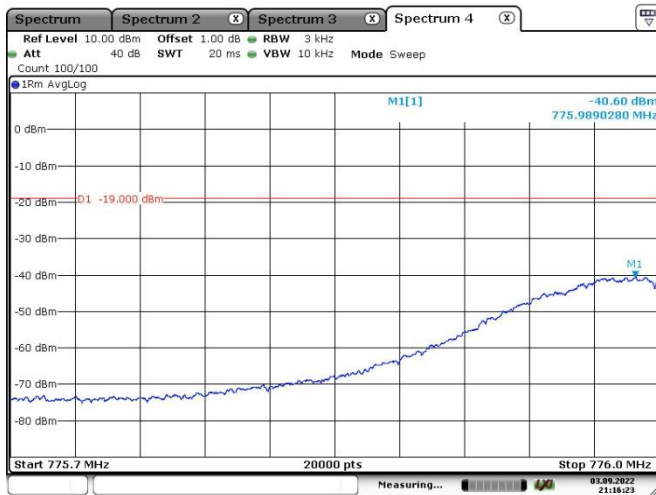
Right Side-WCDMA-Above AGC



Date: 3.SEP.2022 21:03:56

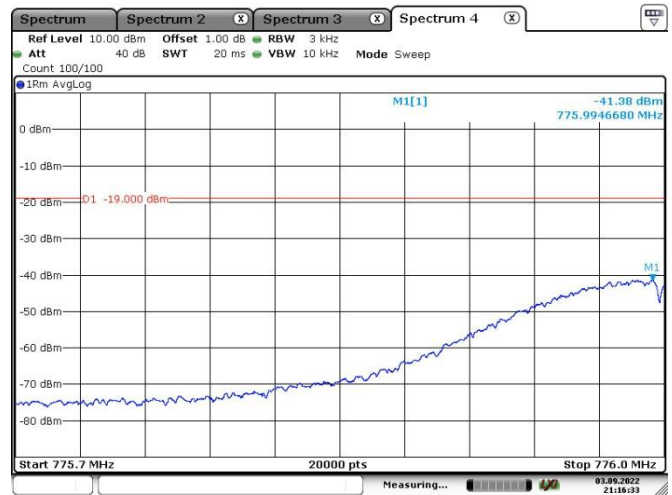
Upper 700M Band Uplink

Left Side-GSM-Pre AGC



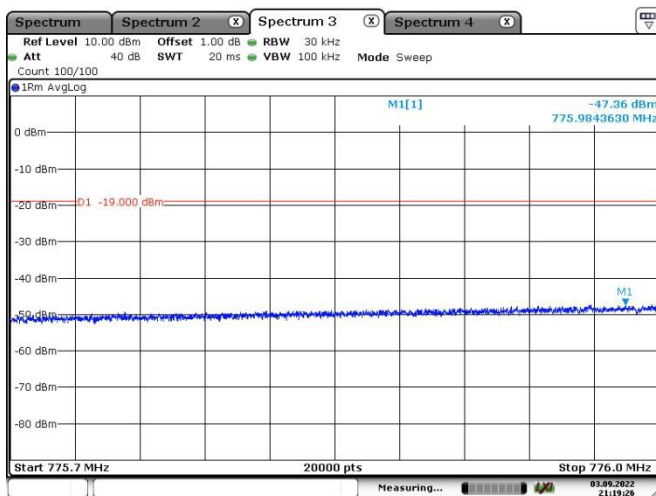
Date: 3.SEP.2022 21:16:22

Left Side-GSM-Above AGC



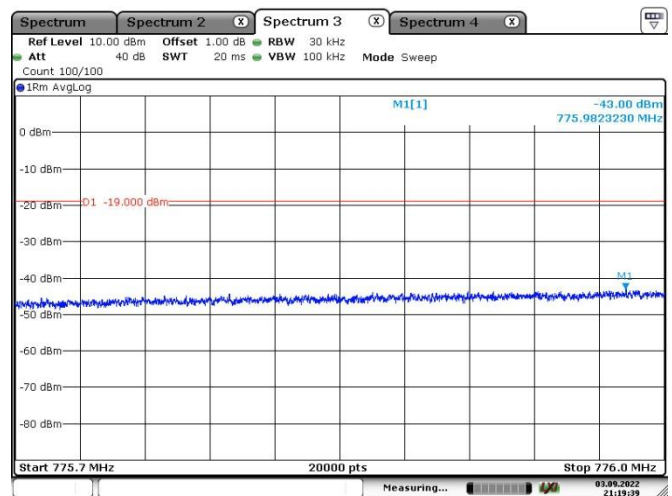
Date: 3.SEP.2022 21:16:33

Left Side-CDMA-Pre AGC



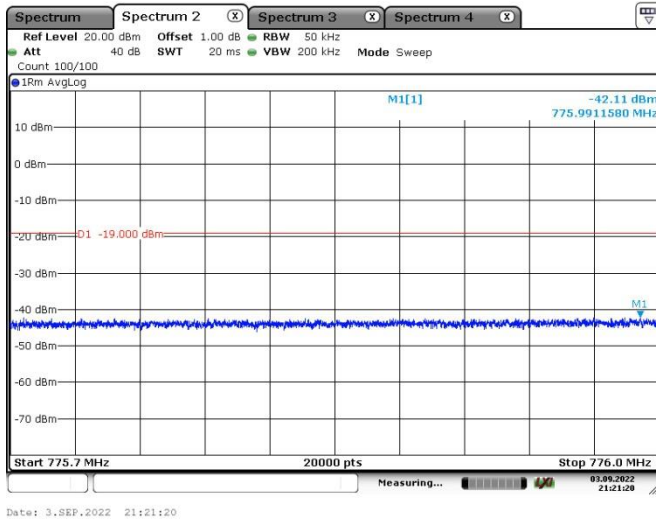
Date: 3.SEP.2022 21:19:26

Left Side-CDMA-Above AGC

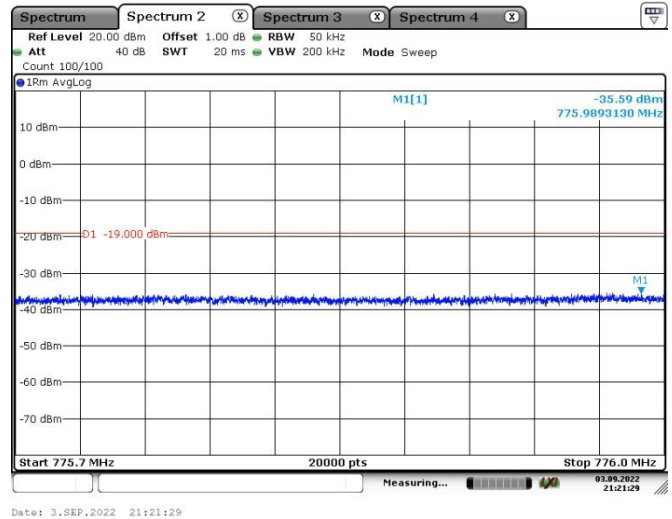


Date: 3.SEP.2022 21:19:39

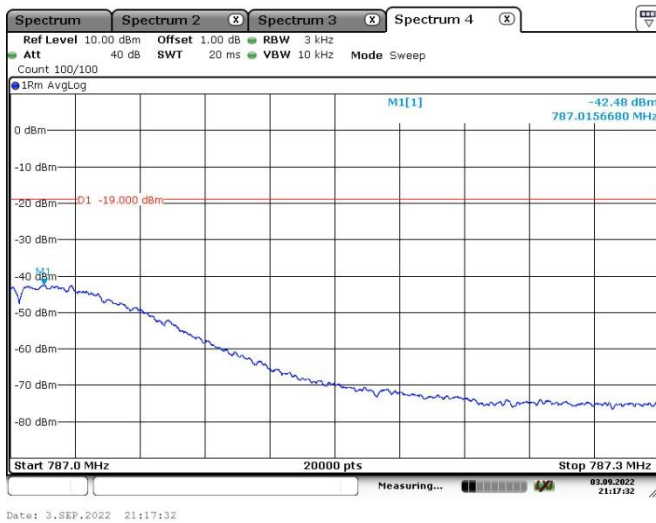
Left Side-WCDMA-Pre AGC



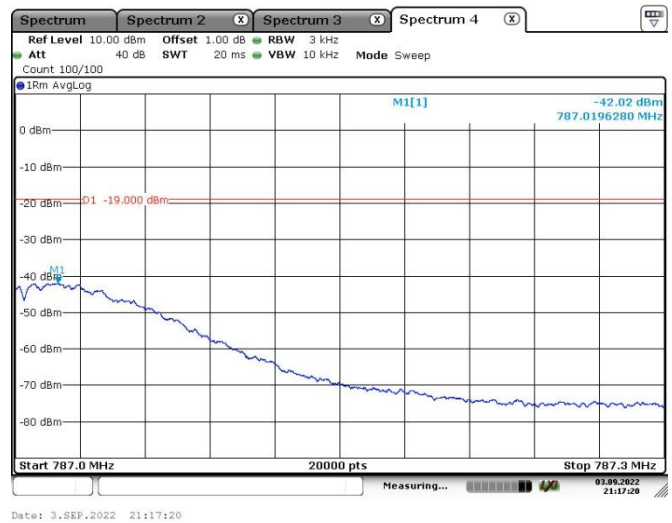
Left Side-WCDMA-Above AGC



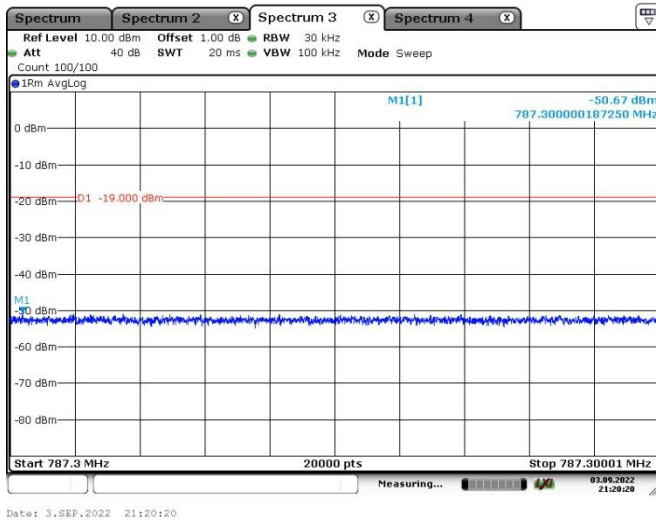
Right Side-GSM-Pre AGC



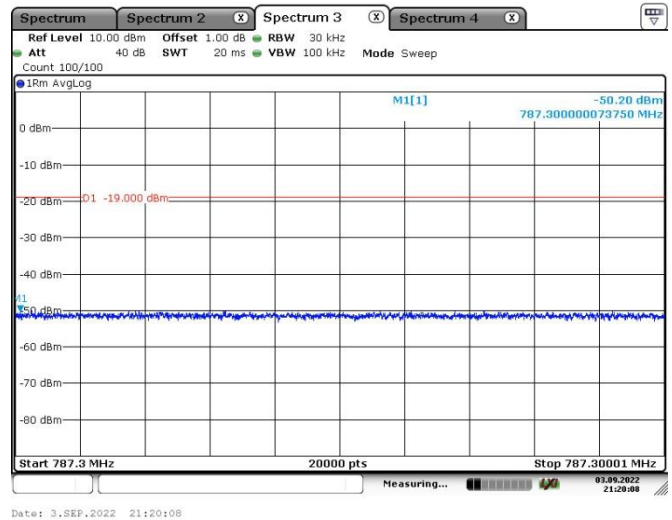
Right Side-GSM-Above AGC



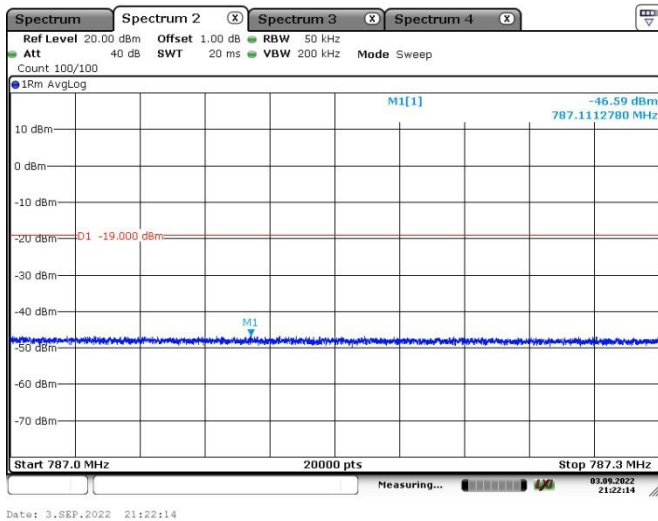
Right Side-CDMA-Pre AGC



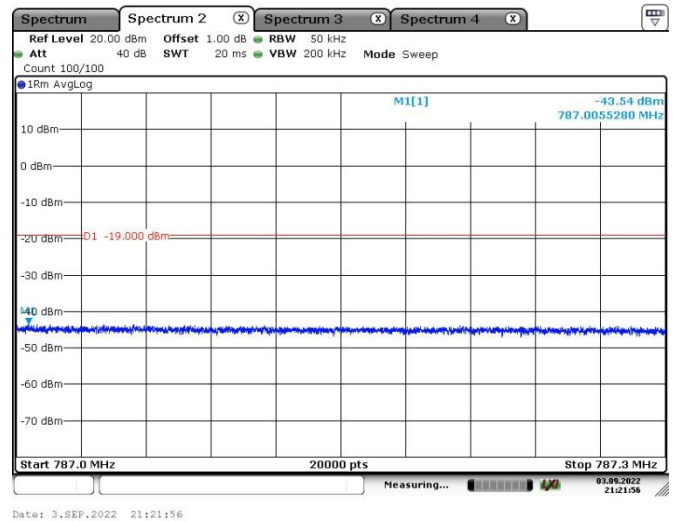
Right Side-CDMA-Above AGC



Right Side-WCDMA-Pre AGC

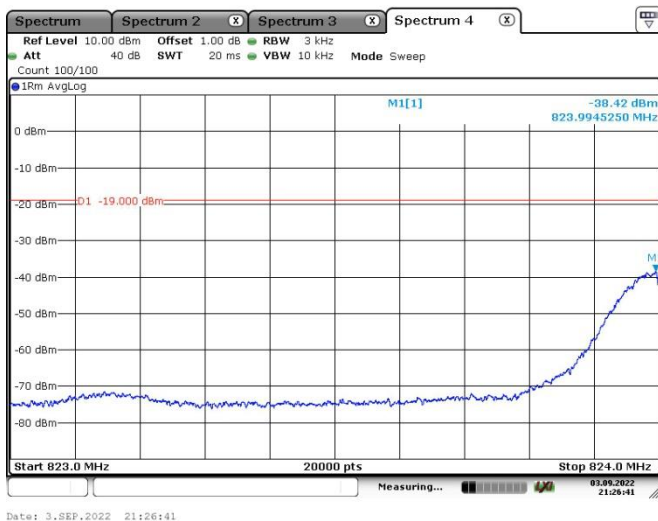


Right Side-WCDMA-Above AGC

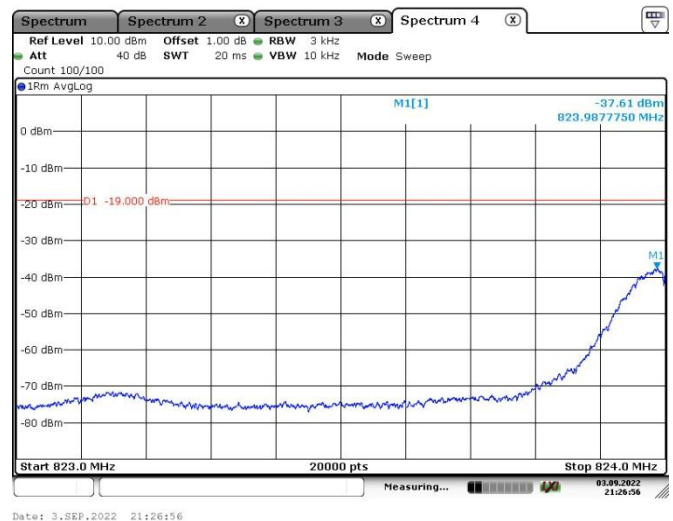


Cellular Band Uplink

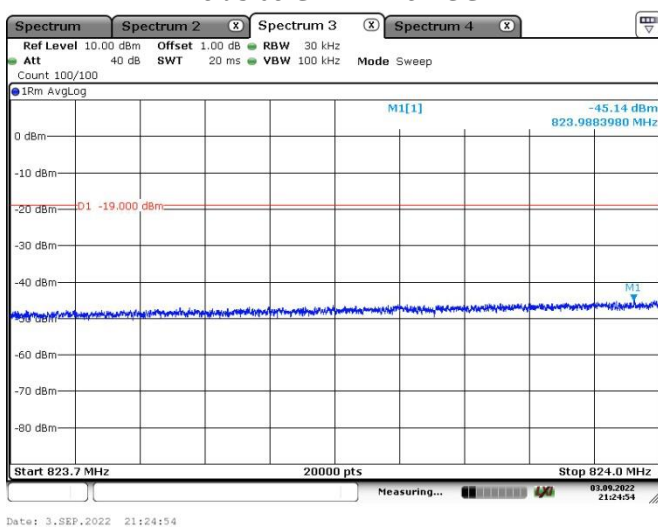
Left Side-GSM-Pre AGC



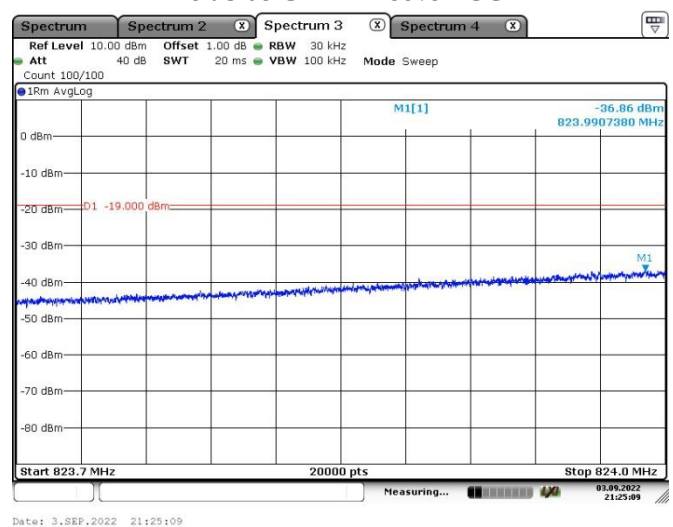
Left Side-GSM-Above AGC



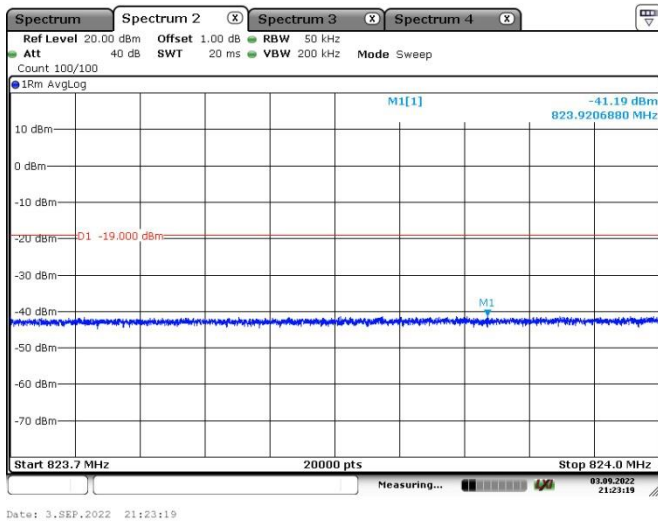
Left Side-CDMA-Pre AGC



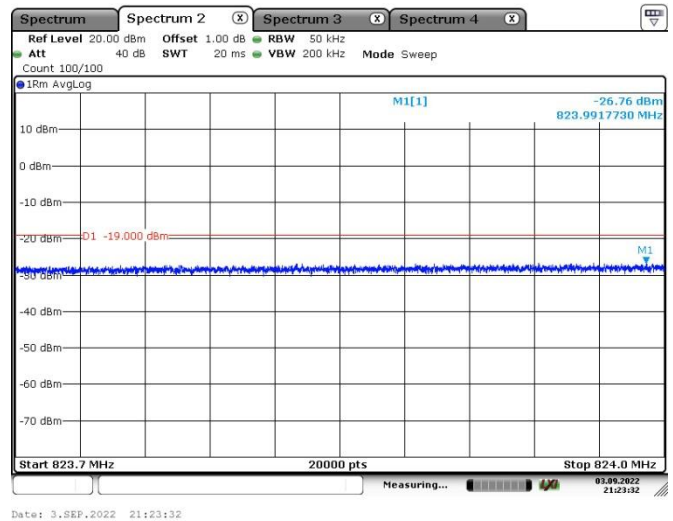
Left Side-CDMA-Above AGC



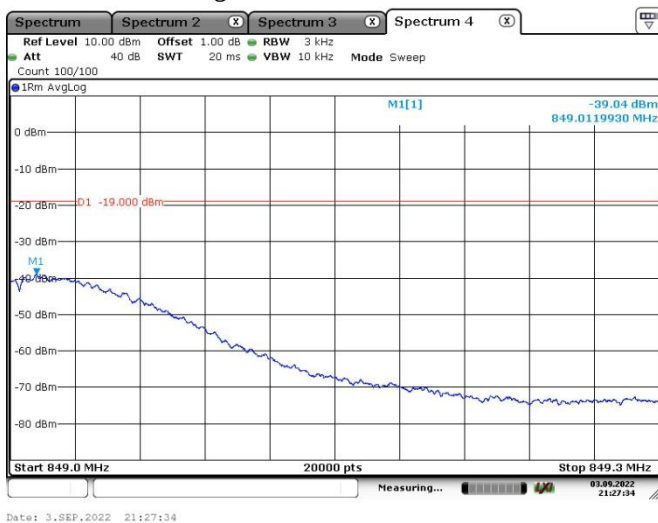
Left Side-WCDMA-Pre AGC



Left Side-WCDMA-Above AGC



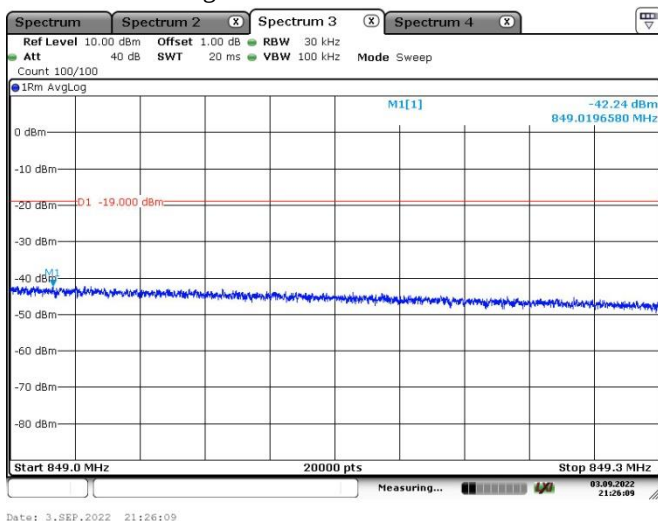
Right Side-GSM-Pre AGC



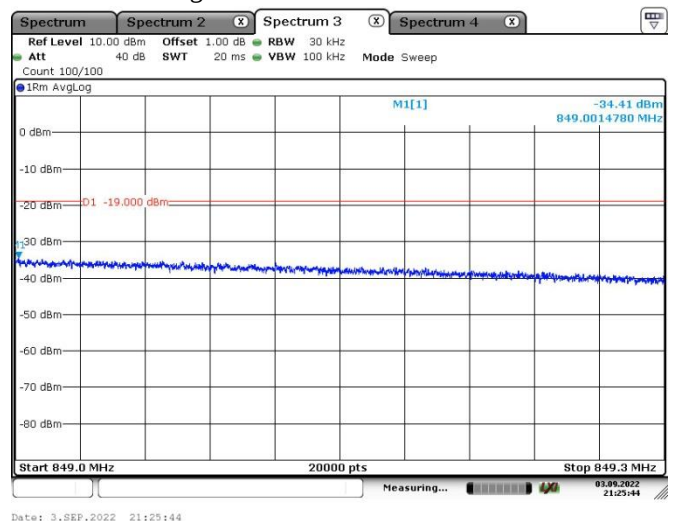
Right Side-GSM-Above AGC



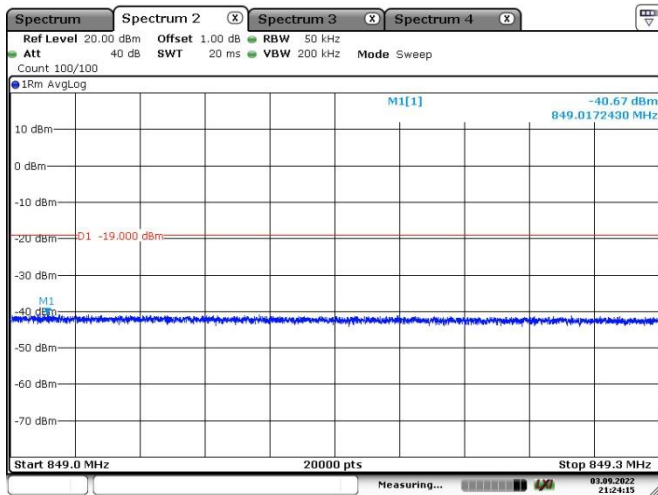
Right Side-CDMA-Pre AGC



Right Side-CDMA-Above AGC

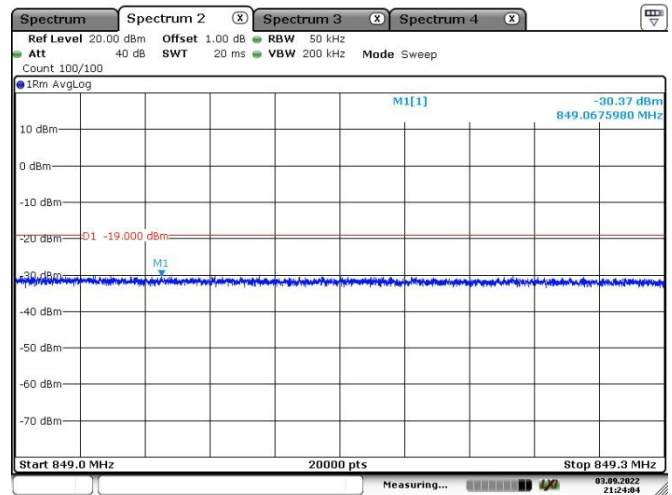


Right Side-WCDMA-Pre AGC



Date: 3.SEP.2022 21:24:15

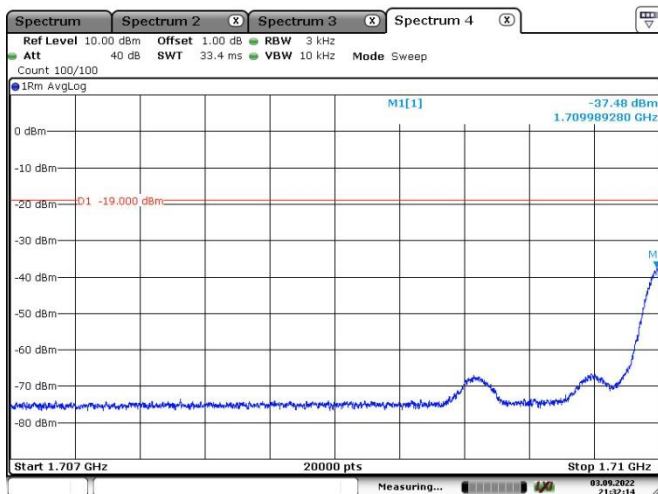
Right Side-WCDMA-Above AGC



Date: 3.SEP.2022 21:24:04

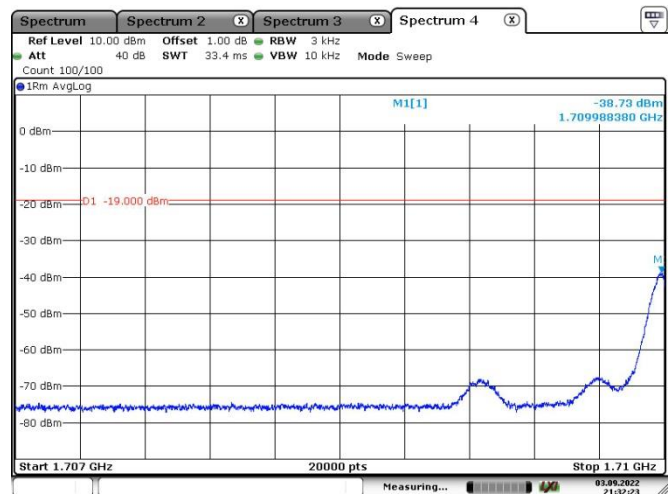
AWS-1 Band Uplink

Left Side-GSM-Pre AGC



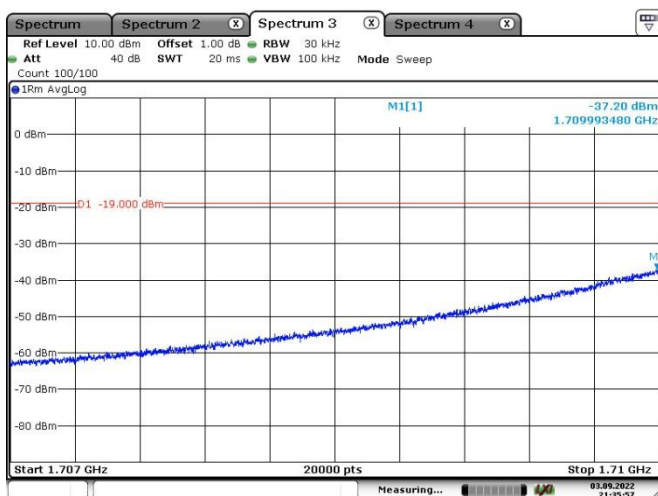
Date: 3.SEP.2022 21:32:14

Left Side-GSM-Above AGC



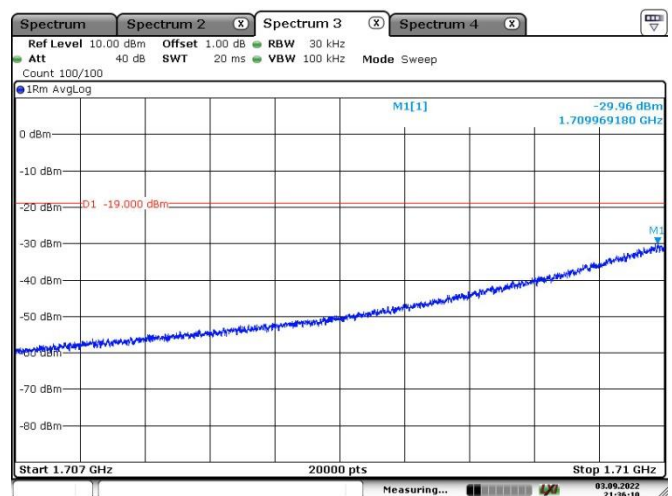
Date: 3.SEP.2022 21:32:23

Left Side-CDMA-Pre AGC



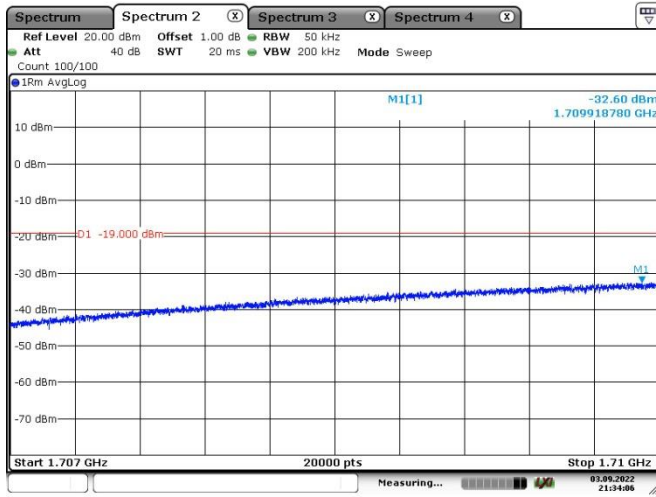
Date: 3.SEP.2022 21:35:37

Left Side-CDMA-Above AGC



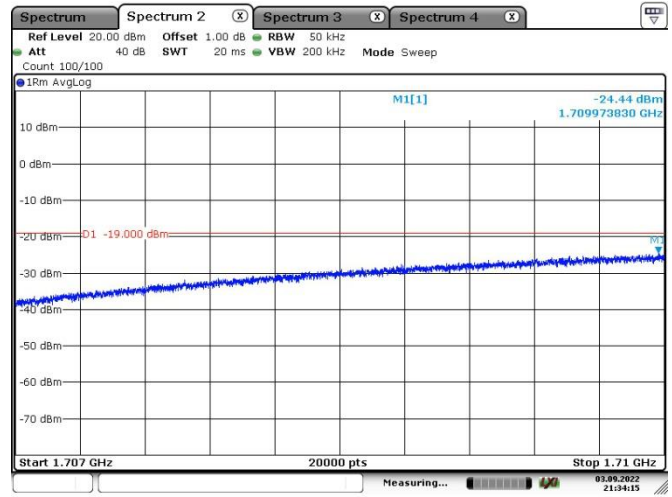
Date: 3.SEP.2022 21:36:10

Left Side-WCDMA-Pre AGC



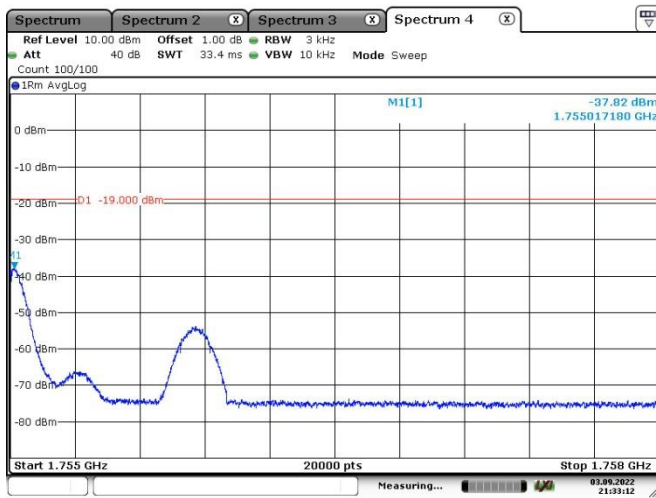
Date: 3.SEP.2022 21:34:06

Left Side-WCDMA-Above AGC



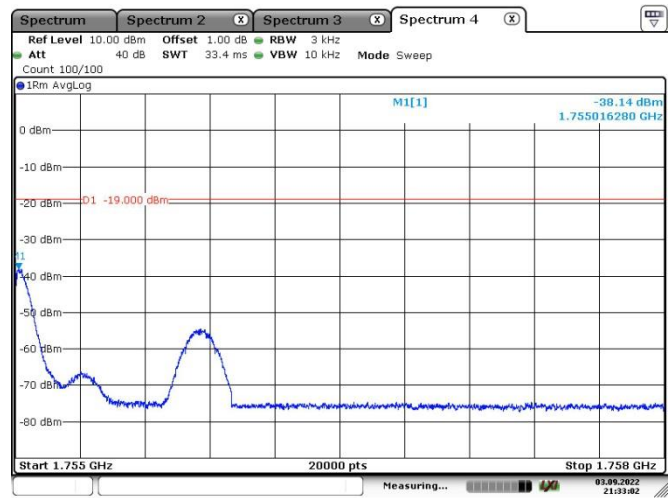
Date: 3.SEP.2022 21:34:15

Right Side-GSM-Pre AGC



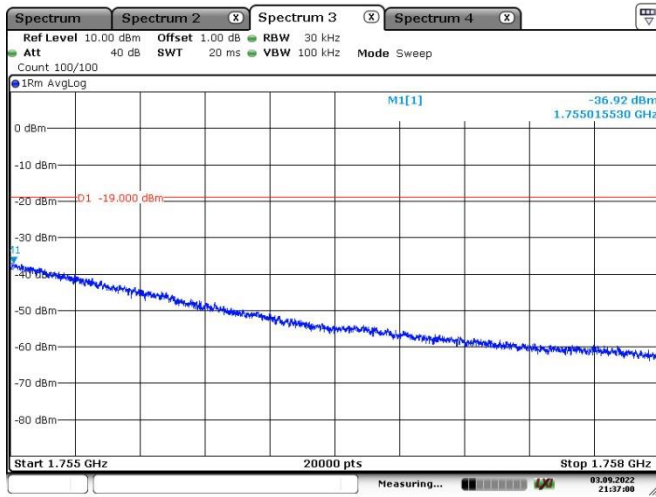
Date: 3.SEP.2022 21:33:12

Right Side-GSM-Above AGC



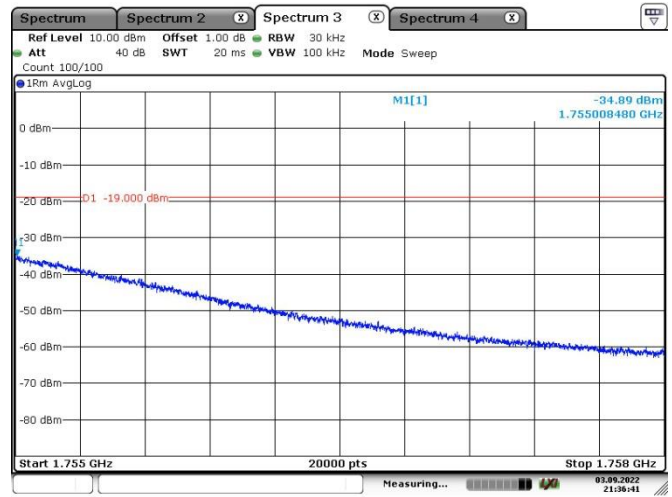
Date: 3.SEP.2022 21:33:02

Right Side-CDMA-Pre AGC



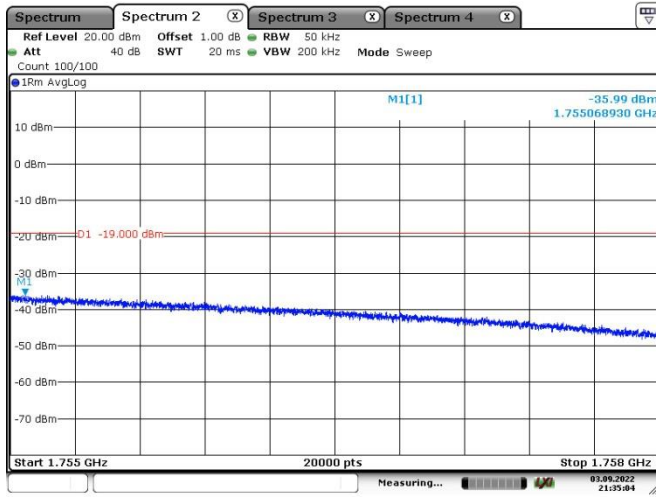
Date: 3.SEP.2022 21:37:00

Right Side-CDMA-Above AGC

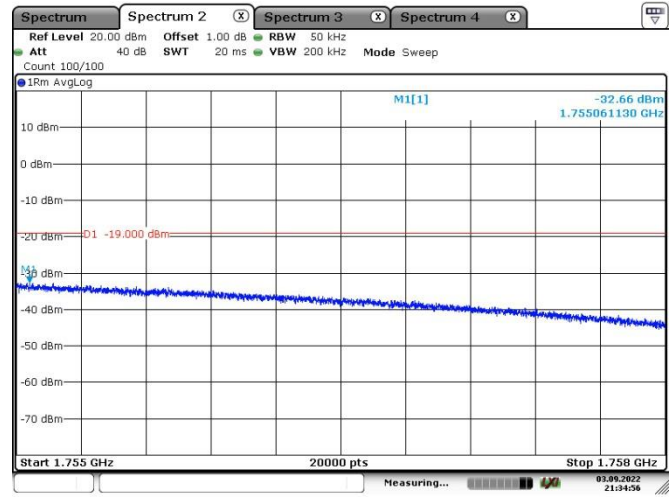


Date: 3.SEP.2022 21:36:41

Right Side-WCDMA-Pre AGC

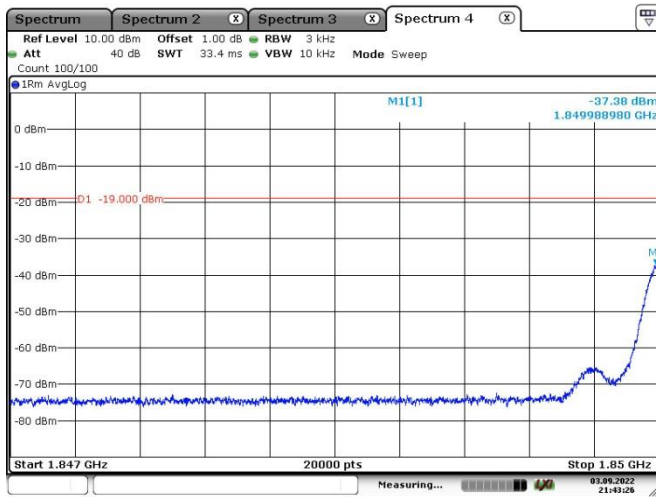


Right Side-WCDMA-Above AGC

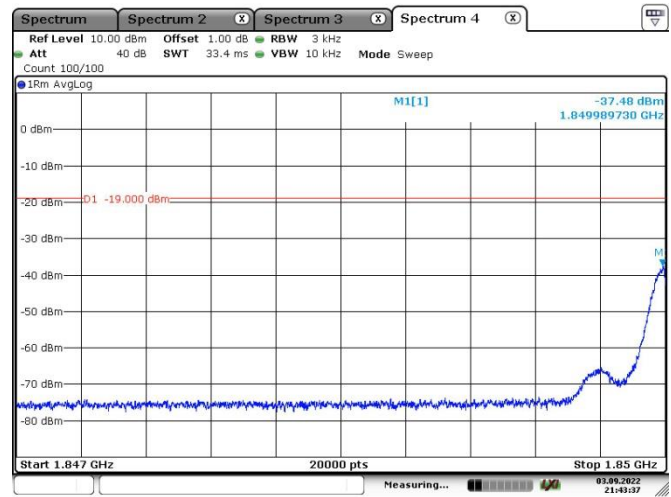


PCS Band Uplink

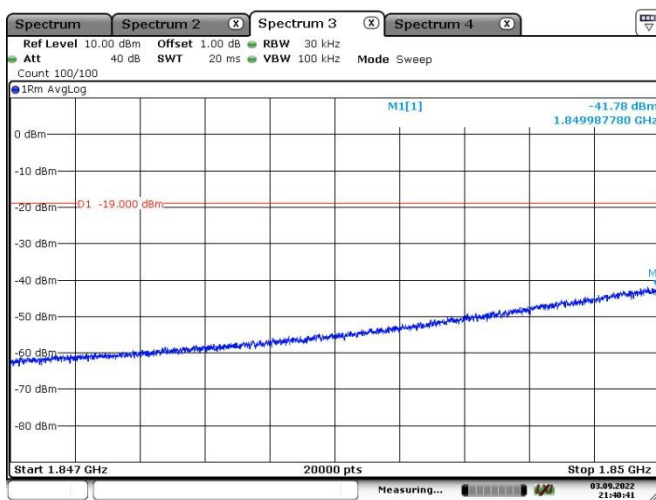
Left Side-GSM-Pre AGC



Left Side-GSM-Above AGC



Left Side-CDMA-Pre AGC



Left Side-CDMA-Above AGC

