

TEST REPORT

Report Number		RAPA15-O-001
Type of Equipment		4G 5-Band Repeater
Model Name		USHR-781921-5B
FCC ID		Q4EUSHR-781921-5B
Applicant	Name	OPISYS INC.
	Logo	 OPISYS, INC.
	Address	511 S. Harbor Blvd, Unit P. La Habra, CA. 90631, USA
Manufacturer	Name	Ace Technology Corp.
	Address	24BL 5L, 451-3, Nonhyeon-dong, Namdong-gu, Incheon, 405-849, Korea
Test duration		January 02, 2015 to February 27, 2015
Date of issue		February 27, 2015
Total Page		205 pages (including this page)

SUMMARY

The equipment complies with FCC CFR 47 Part 20.

This test report contains only the results of a single test of the sample supplied for the examination.
It is not a general valid assessment of the features of the respective products of the mass-production.

February 27, 2015



Tested by Hyun Soo Lee
Manager

February 27, 2015



Reviewed by Sukil Park
Executive Managing Director

Test Report Version History

Version	Date	Revised by	Reason for revision
1.0	January 24, 2015	Hyun Soo Lee	Original Document
2.0	February 09, 2015	Hyun Soo Lee	1. Conducted spurious emission test results update 2. Out of band emission test procedure update(935210 D03 Signal Booster Measurement v02r01) 3. Noise limit test results update
3.0	February 13, 2015	Hyun Soo Lee	Frequency band name modification BAND2 -> BAND25
4.0	February 27, 2015	Hyun Soo Lee	Uplink Output power and MPE update

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1. General description of EUT

1.1 Applicant

- Company name : OPISYS INC.
- Address : 511 S. Harbor Blvd, Unit P. La Habra, CA. 90631, USA
- Contact person : Justin Park
- Phone/Fax : +1-562-448-3102 / +1-562-448-3105

1.2 Manufacturer

- Company name : Ace Technology Corp.
- Address : 24BL 5L, 451-3, Nonhyeon-dong, Namdong-gu, Incheon, 405-849, Korea
- Phone / Fax : +82-32-458-1382 / +82-32-458-1646

1.3 Basic description of EUT

- Product name : 4G 5-Band Repeater
- Model name : USHR-781921-5B
- Frequency :

	BAND12	BAND13	BAND5	BAND4	BAND25
Downlink (MHz)	728~746	746~757	869~894	2110~2155	1930~1955
Uplink (MHz)	698~716	776~787	824~849	1710~1755	1850~1915

- Output power : Downlink : +2 dBm, Uplink : +23 dBm
- Emission Designators : GSM(GXW), EDGE(G7W), CDMA(F9W), WCDMA(F9W), EVDO(F9W)
LTE(G7D)
- FCC Rule Part(s) : FCC CFR47 Part 20
- FCC classification : B2W/Wideband Consumer Booster (CMRS)
- Test duration : January 02, 2015 to February 27, 2015
- Date of issue : February 27, 2015
- Place of test : Head office

#101 & B104 Anyang Megavalley, 268, Hagui-ro, Dongan-gu,
Anyang-si, Gyeonggi-do, 431-767, Korea

Open area test site

103, Anseok-gil, 138beon-gil, Hwaseong-si, Gyeonggi-Do, Korea
(FCC Registration Number : 931589)
(IC Company address code : 9355B)
(RRA Designation Number : KR0027)

1.4 Electrical specification

Item		Specifications	Note
Frequency Range	Up Link	698 MHz ~ 716 MHz	BAND12
	Down Link	728 MHz ~ 757MHz	BAND12 / BAND13
	Up Link	776 MHz ~ 787 MHz	BAND 13
	Down Link	869 MHz ~ 894 MHz	BAND 5
	Up Link	824 MHz ~ 849 MHz	
	Down Link	2110 MHz ~ 2155 MHz	BAND 4
	Up Link	1710 MHz ~ 1755 MHz	
	Down Link	1930 MHz ~ 1995 MHz	BAND 25
	Up Link	1850 MHz ~ 1915 MHz	
Modulation Type	GSM, EDGE, CDMA, EVDO, HSPA, LTE		
Input Power limit	Down Link	-40dBm max	BAND12
	Up Link	-10dBm max	
	Down Link	-40dBm max	BAND13
	Up Link	-10dBm max	
	Down Link	-40dBm max	BAND 5
	Up Link	-10dBm max	
	Down Link	-40dBm max	BAND 4
	Up Link	-17dBm max	
	Down Link	-40dBm max	BAND 25
	Up Link	-17dBm max	
Output Power	Down Link	+2dBm@ booster output port	ALL DL Channel
	Up Link	+23dBm@ booster output port	ALL UL Channel
Gain(RSSI)	Up Link	30dB ~ 60dB (± 1.0 dB)	BAND 12
	Down Link	42dB ~ 60dB (± 1.0 dB)	BAND 12 / BAND 13
	Up Link	31dB ~ 61dB (± 1.0 dB)	BAND 13
	Down Link	42dB ~ 62dB (± 1.0 dB)	BAND 5
	Up Link	31dB ~ 61dB (± 1.0 dB)	
	Down Link	42dB ~ 70dB (± 1.0 dB)	BAND 4
	Up Link	38dB ~ 68dB (± 1.0 dB)	
	Down Link	42dB ~ 69dB (± 1.0 dB)	BAND 25
Gain(ALC)	Up Link	33dB ~ 60dB (± 1.0 dB)	BAND 12
	Down Link	42dB ~ 60dB (± 1.0 dB)	BAND 12 / BAND 13 BAND 13
	Up Link	33dB ~ 61dB (± 1.0 dB)	
	Down Link	42dB ~ 62dB (± 1.0 dB)	BAND 5
	Up Link	33dB ~ 61dB (± 1.0 dB)	
	Down Link	42dB ~ 70dB (± 1.0 dB)	BAND 4
	Up Link	40dB ~ 68dB (± 1.0 dB)	
	Down Link	42dB ~ 69dB (± 1.0 dB)	BAND 25
	Up Link	40dB ~ 68dB (± 1.0 dB)	

Item			Specifications		Note
Ripple	Down / Up Link		<8dB / < 8dB(Peak to Peak)		
Noise Figure	Down / Up Link		< 8.0dB / < 8.0dB		ALL BAND Max Gain
Noise Power Limit	Down Link		< -70dBm/MHz		On shutdown
	Up Link		< -70dBm/MHz		On shutdown & sleep mode
	Down / Up Link		FCC		ALL BAND
	Down / Up Link		FCC		ALL BAND
Propagation Delay			< 3us		
Input VSWR			≤ 2.0 : 1		
ALC Setting Level	Down Link (Upper Value)		+2dBm±1.0dB		
	Window Size (Lower Offset)		1 ~ 10dB(Default : 2dB)		
	Up Link (Upper Value)		+23dBm±1.0dB		
	Window Size (Lower Offset)		1 ~ 10dB(Default : 2dB)		
ALC Range	Down / Up Link		DL ≤ 18dB	UL ≤ 27dB	Band 12
	Down / Up Link		DL ≤ 18dB	UL ≤ 28dB	BAND 13
	Down / Up Link		DL ≤ 20dB	UL ≤ 28dB	BAND 5
	Down / Up Link		DL ≤ 28dB	UL ≤ 28dB	BAND 4
	Down / Up Link		DL ≤ 27dB	UL ≤ 28dB	BAND 25
Shutdown Level	Down Link		≥-40dBm/Total±1.0dB		ALL Down Link
	Up Link		≥-10dBm/Total±1.0dB		Band12, Band13, Band 5
	Up Link		≥-17dBm/Total±1.0dB		Band 4, BAND 25
OSC Level	Down Link		DL detects OSC under 1 sec.		
	Up Link		UL detects OSC under 0.3 sec.		
Uplink In-activity	Up link		On@ > -88dBm, OFF@ < -90dBm		- No uplink signal for 5minutes
Gain Control Range	Dip Switch	Down link	0dB ~ 30dB / 1dB Step		- Be controlled GUI or Dip Switch - Total Atten Control Range : 0dB ~ 30dB / 1dB Step
		Up link	0dB ~ 30dB / 1dB Step		
Gain Control Deviation			< ± 1dB		
EVM			< 7%		No Feedback
Isolation checking Range			30dB ~ 75dB / BAND12		Detecting deviation: < ±2.0dB
			31dB ~ 76dB / BAND13		
			31dB ~ 76dB / BAND 5		
			38dB ~ 83dB / BAND 4		
			38dB ~ 83dB / BAND 25		
In band Spurious (Operating band unwanted emissions)			Category A		3GPP TS 36.106
Out Band Spurious			< -13dBm/1kHz RBW		9kHz ~ 150kHz
			< -13dBm/10kHz RBW		150kHz ~ 30MHz
			< -13dBm/100kHz RBW		30MHz ~ 1GHz
			< -13dBm/1MHz RBW		1GHz ~ 12.75GHz

Item		Specifications		Note
3rd IMD Level		< -19dBm		Max Output Level
Frequency Stability		≤ ±0.01ppm		
GUI Interface		RS-232C		
Alarm & Status	Display	PWR	▪ Normal: Green ▪ Power turn off: Off	
		Alarm	▪ Normal: Green ▪ Over Power Shutdown: RED ▪ Checking SD: Green Blinking per 1 sec cycle ▪ Checking OSC Algorithm: Red Blinking per 1 sec cycle ▪ Sleep Mode: Green Blinking per 5 sec cycle ▪ ISO SD : RED Blinking per 5 sec cycle	
Power Consumption		< 50W		
Operating Power		AC/DC Adapter(AC110V or AC220V)		
RF Connector		N-type Female		

1.5 Mechanical specification

Item	Specifications	Note
Dimensions (L × W × H)	231 mm x 288 mm x 71 mm	-
Weight	< 6.8 Kg	-

1.6 Environmental specification

Item	Specifications	Note
Temperature	-30 °C ~ 55 °C	-
Relative Humidity	10 % ~ 95 %	-

1.7 AC/DC adaptor specification

Item	Specifications	Note
AC input power	90 Vac ~ 264 Vac, 47 Hz ~63 Hz	-
Output rated Voltage	+11.4 Vdc ~ +12.6 Vdc / 6 A	-
Voltage Current range	6 A ~ 0.0 A	-
Operation Temperature	0 °C ~ +40 °C	-
Operation humidity	10 % ~ 90 %	-

2. General information of test

2.1 Test standards and results

Applied Standards : FCC CFR47 Part 20			
FCC part	Section	Description of Test	Result
Part 20.21	(e)(3)	Authorized frequency band verification	Pass
Part 20.21	(e)(8)(i)(B) & (D)	Maximum power measurement	Pass
Part 20.21	(e)(8)(i)(B) & (C)(2)	Maximum booster gain computation	Pass
Part 20.21	(e)(8)(i)(F)	Intermodulation product	Pass
Part 20.21	(e)(8)(i)(E)	Out of band emission	Pass
Part 2	2.1051	Conducted spurious emission	Pass
Part 22.917	(a)		
Part 24.238	(a)		
Part 27.53	(c),(g),(h)		
Part 20.21	(e)(8)(i)(A)	Noise limit	Pass
Part 20.21	(e)(8)(i)(J)	Uplink inactivity	Pass
Part 20.21	(e)(8)(i)(C)	Variable booster gain	Pass
Part 2	2.1049	Occupied bandwidth	Pass
Part 20.21	(e)(8)(ii)(A)	Oscillation detection	Pass
Part 2	2.1053	Radiated spurious emission	Pass
Part 20.21	(e)(8)(i)(B)	Spectrum block filtering *	N/A

* This device is not using spectrum block filtering.

2.2 Description of EUT modification

During the test, there was no mechanical or circuitry modification to improve RF and spurious characteristic, and any RF and spurious suppression device(s) was not added against the device tested.

2.3 Test configuration

• Type of peripheral equipment used

Model	Manufacturer	Description	Connected to	Remark
USHR-781921-5B	OPISYS Incorporated	Dual Band Repeater	-	-
N5182A / E4432B	Agilent	Signal Generator	EUT	-
N9020A	Agilent	Spectrum Analyzer	EUT	

• Type of cable used

Device from	Device to	Type of Cable	Length (m)	Shielded
EUT	Signal Generator	N-Type	2	Y
EUT	Attenuator	N-Type	1	Y
Attenuator	Spectrum Analyzer	N-Type	1	Y

3. Measurement data

3.1 Authorized frequency band verification

This test is intended to confirm that the Signal Booster only operates on the CMRS frequency bands authorized for use by the NPS. In addition, this test will identify the frequency at which the maximum gain is realized with each CMRS operational band, which then serves as a basis for subsequent tests.

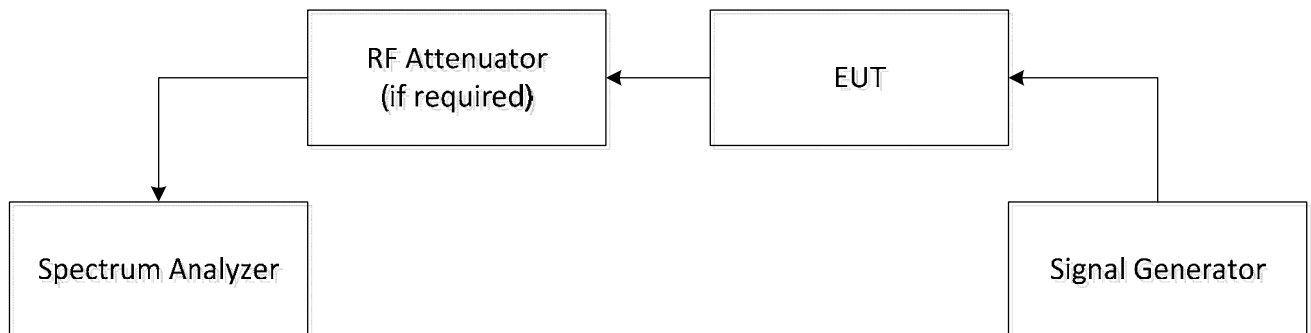
3.1.1 Specification

- FCC Part 20.21 (e)(3)

3.1.2 Measurement method

- 935210 D03 Signal Booster Measurement v02r01
- a) Connect the EUT to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer.
 - b) Set the spectrum analyzer RBW for 100 kHz with the VBW $\geq 3X$ 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 and manually reset the EUT.
 - h) Reset the spectrum analyzer span to 2 times the CMRS band under test. Adjust the tuned frequency of the signal generator to sweep 2 times the CMRS band using the sweep function. Note: The AGC must not be activated throughout entire sweep.
 - i) Using three markers identify the CMRS band edges and the frequency with the highest power. Ensure 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 steps c) to j) for all operational uplink and downlink bands.

3.1.3 Set-Up



3.1.4 Test equipment list

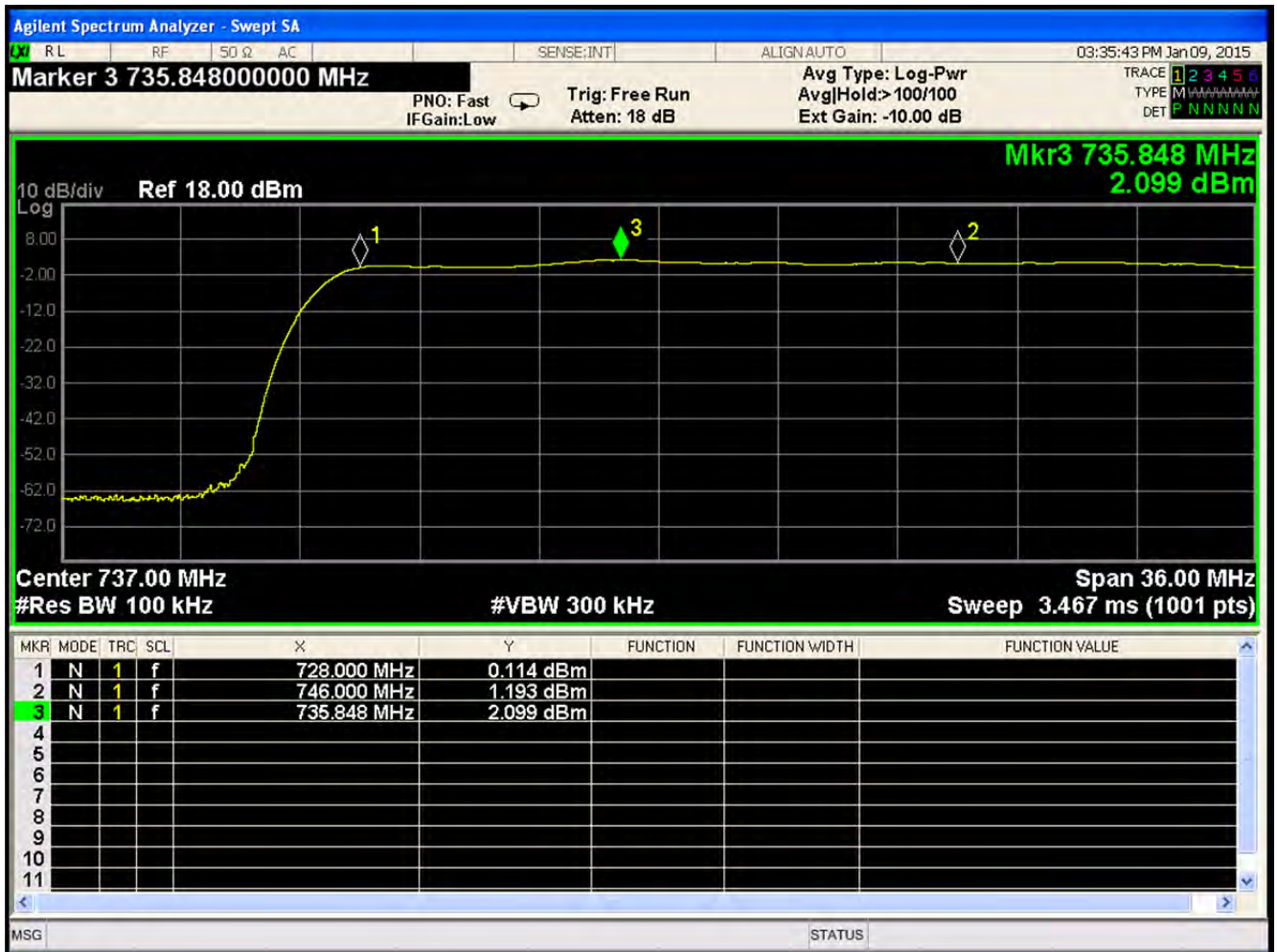
Equipment	Model Name	Manufacturer
EUT	USHR-781921-5B	OPISYS Incorporated
Signal Generator	N5182A	Agilent
Spectrum Analyzer	N9020A	Agilent
Attenuator	AF115A-09-34	Weinschel

3.1.5 Test condition

- Test place: Shield Room
- Test environment: 23.0 °C, 44 % R.H.

3.1.6 Test plots

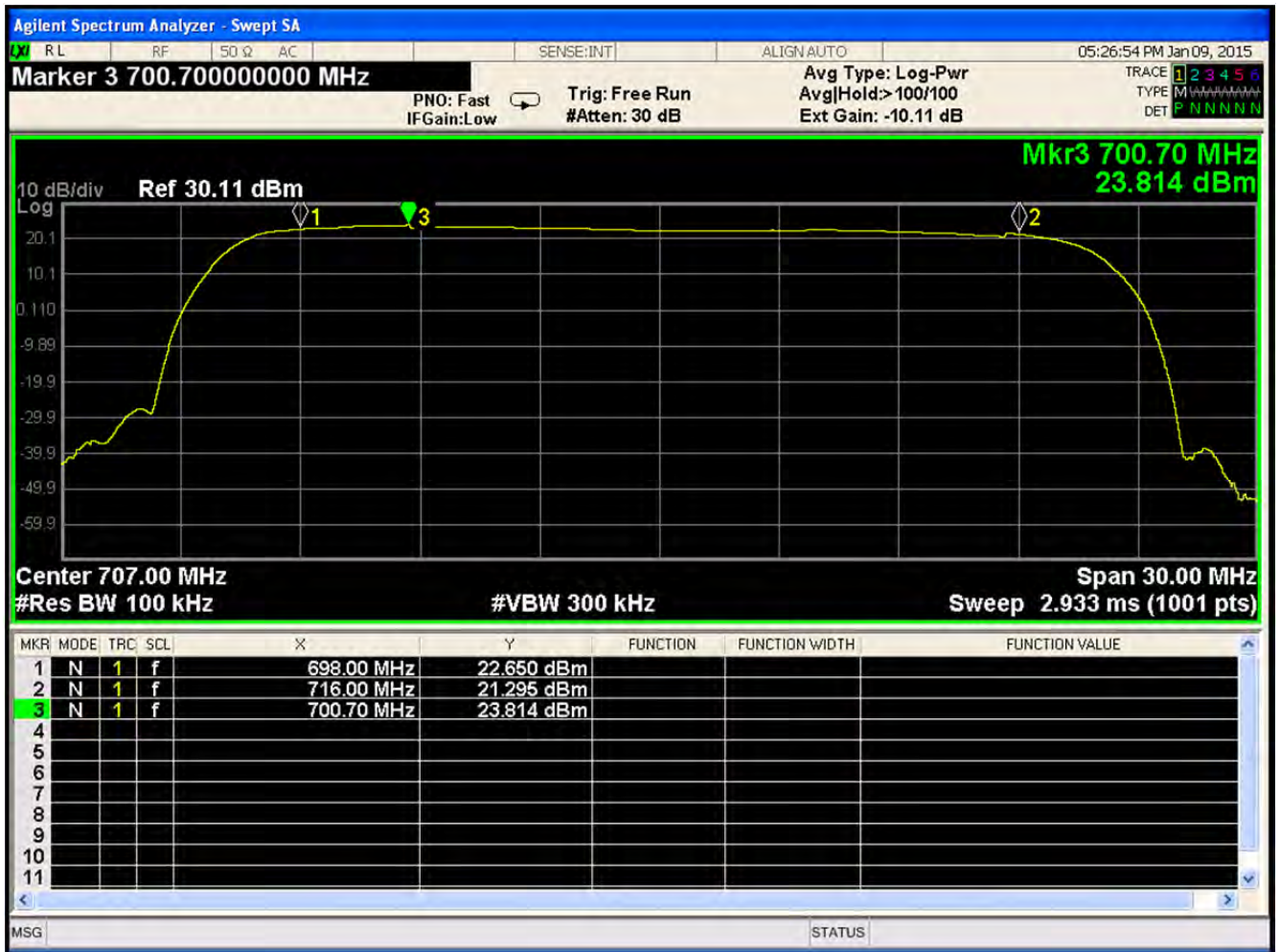
- Band 12 / Downlink



RBW : 100 kHz
VBW : 300 kHz
Detector mode : Peak
Trace mode : Max hold

Frequency of lower edge : 728.000 MHz
Frequency of upper edge : 746.000 MHz
Frequency of highest power : 735.848 MHz

• Band 12 / Uplink



RBW : 100 kHz

VBW : 300 kHz

Detector mode : Peak

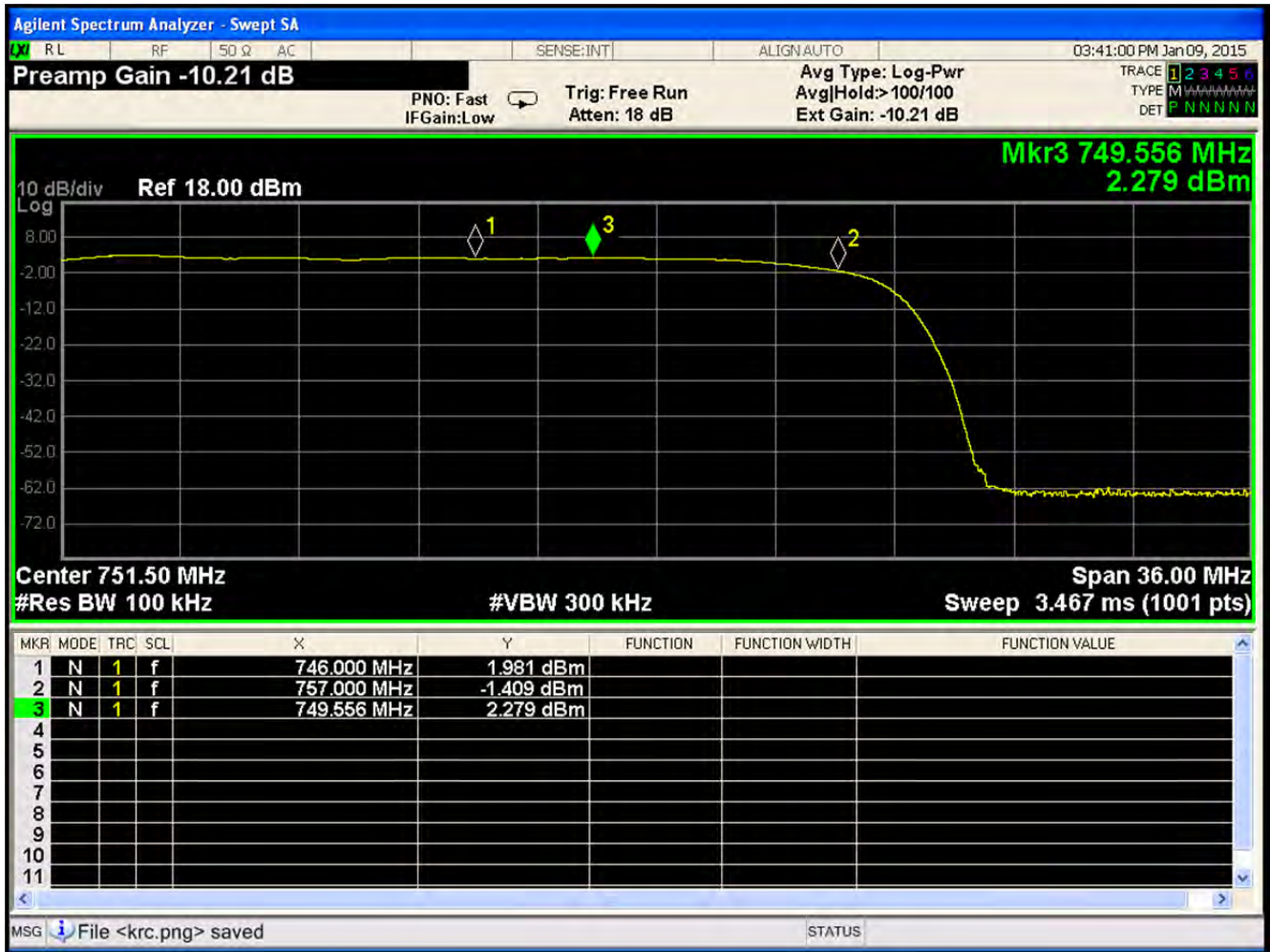
Trace mode : Max hold

Frequency of lower edge : 698.00 MHz

Frequency of upper edge : 716.00 MHz

Frequency of highest power : 700.70 MHz

• Band 13 / Downlink



RBW : 100 kHz

VBW : 300 kHz

Detector mode : Peak

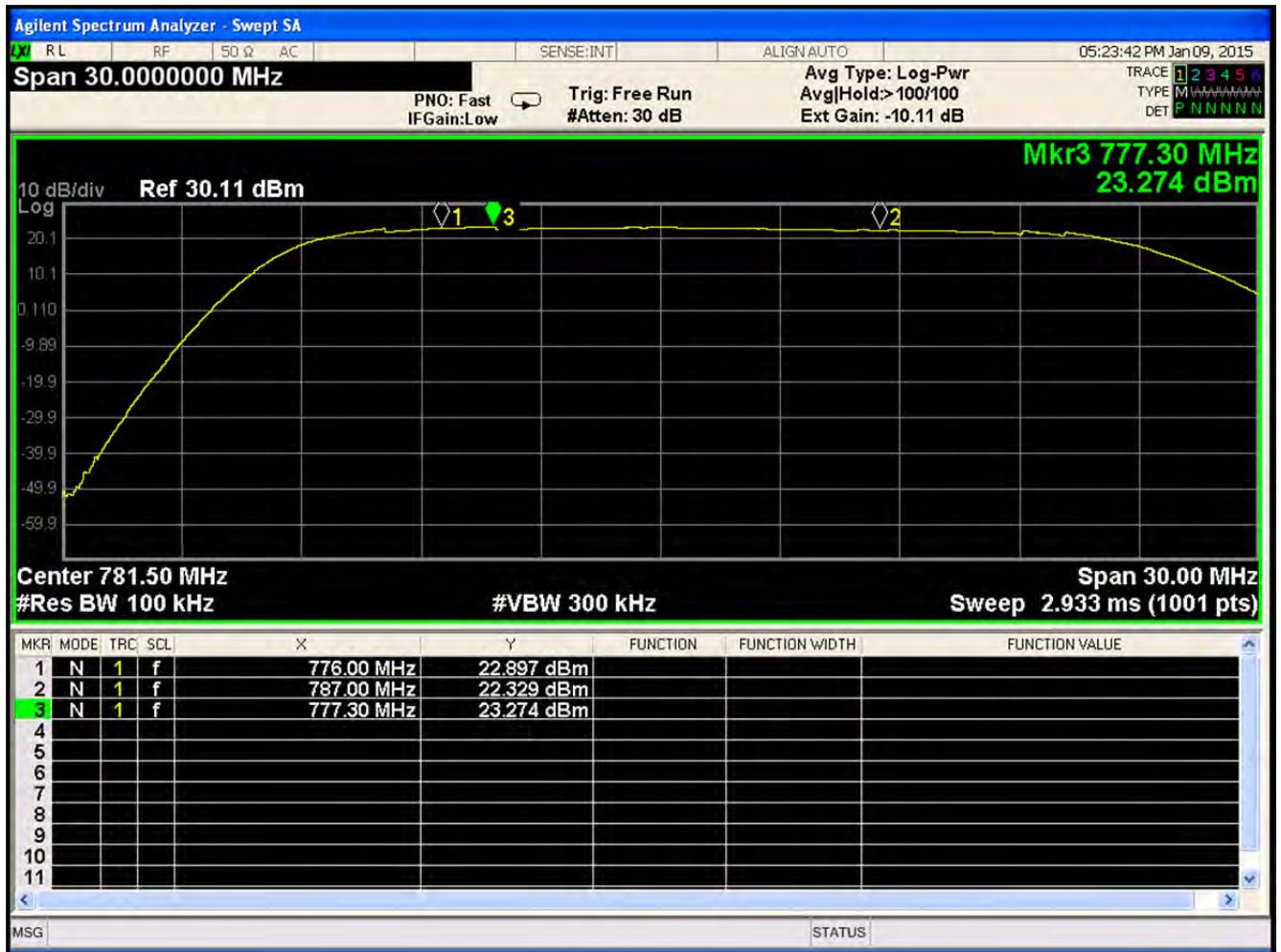
Trace mode : Max hold

Frequency of lower edge : 746.000 MHz

Frequency of upper edge : 757.000 MHz

Frequency of highest power : 749.556 MHz

• Band 13 / Uplink



RBW : 100 kHz

VBW : 300 kHz

Detector mode : Peak

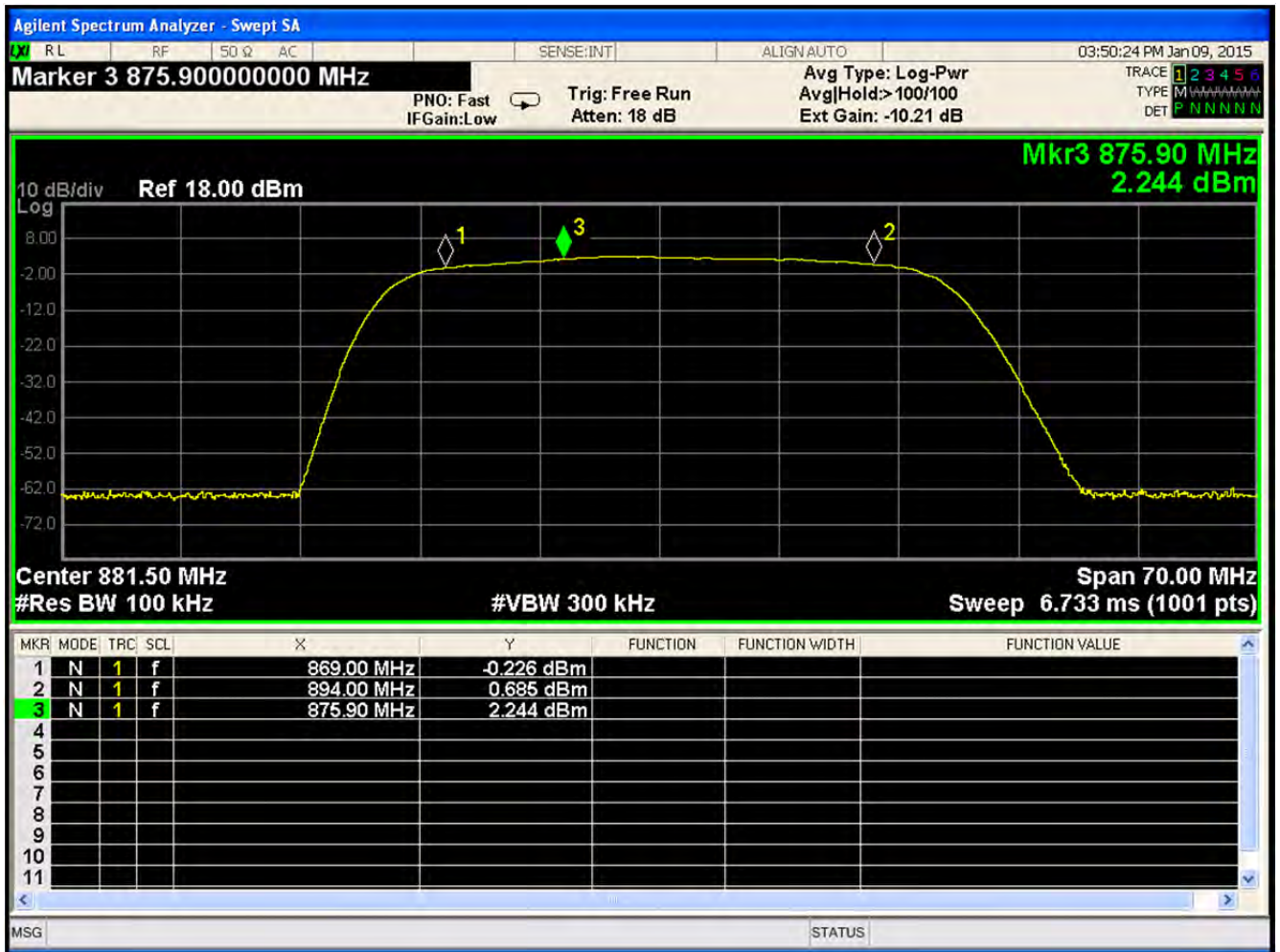
Trace mode : Max hold

Frequency of lower edge : 776.00 MHz

Frequency of upper edge : 787.00 MHz

Frequency of highest power : 777.30 MHz

• Band 5 / Downlink



RBW : 100 kHz

VBW : 300 kHz

Detector mode : Peak

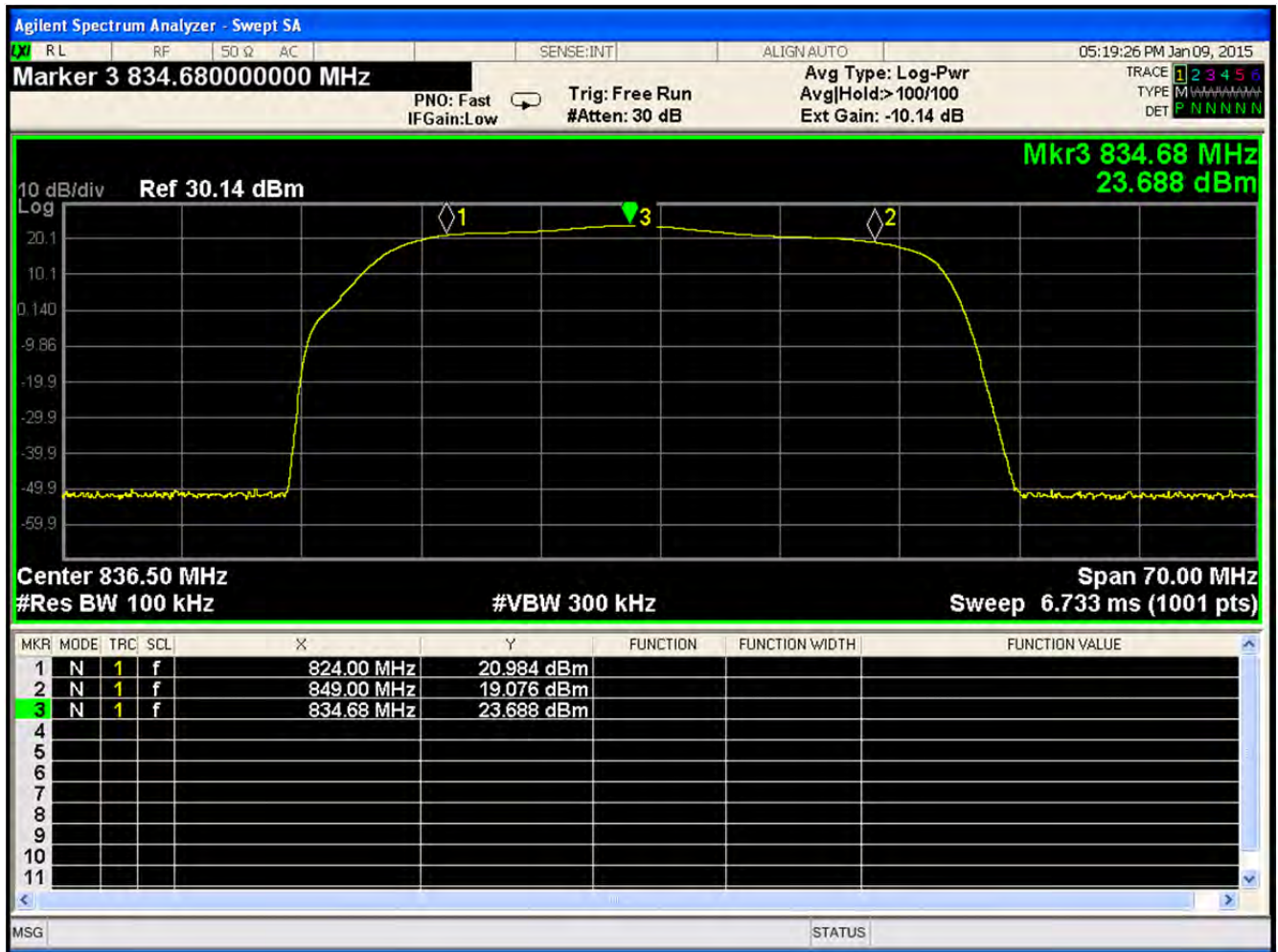
Trace mode : Max hold

Frequency of lower edge : 869.000 MHz

Frequency of upper edge : 894.000 MHz

Frequency of highest power : 875.900 MHz

• Band 5 / Uplink



RBW : 100 kHz

VBW : 300 kHz

Detector mode : Peak

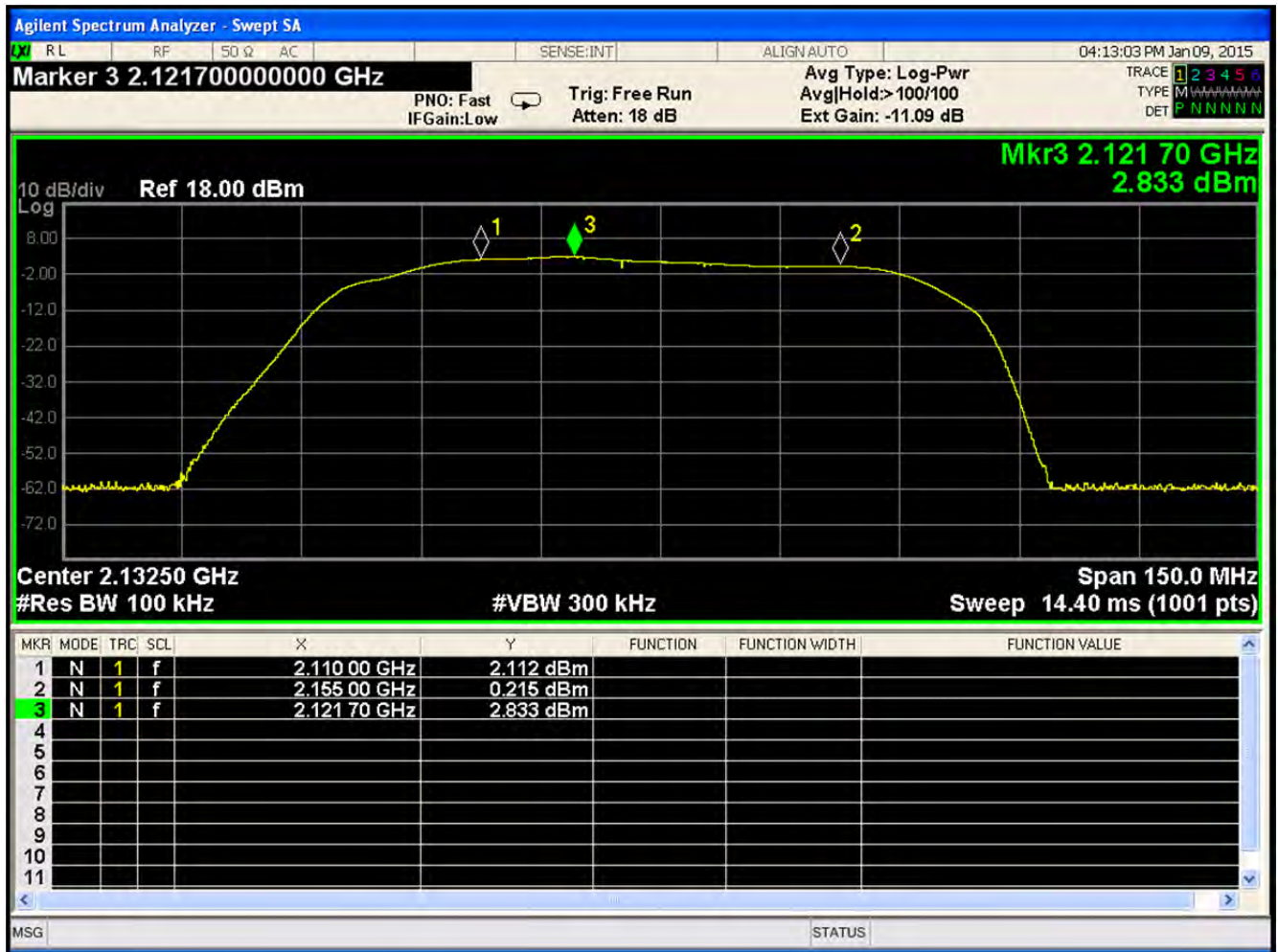
Trace mode : Max hold

Frequency of lower edge : 824.00 MHz

Frequency of upper edge : 849.00 MHz

Frequency of highest power : 834.68 MHz

• Band 4 / Downlink



RBW : 100 kHz

VBW : 300 kHz

Detector mode : Peak

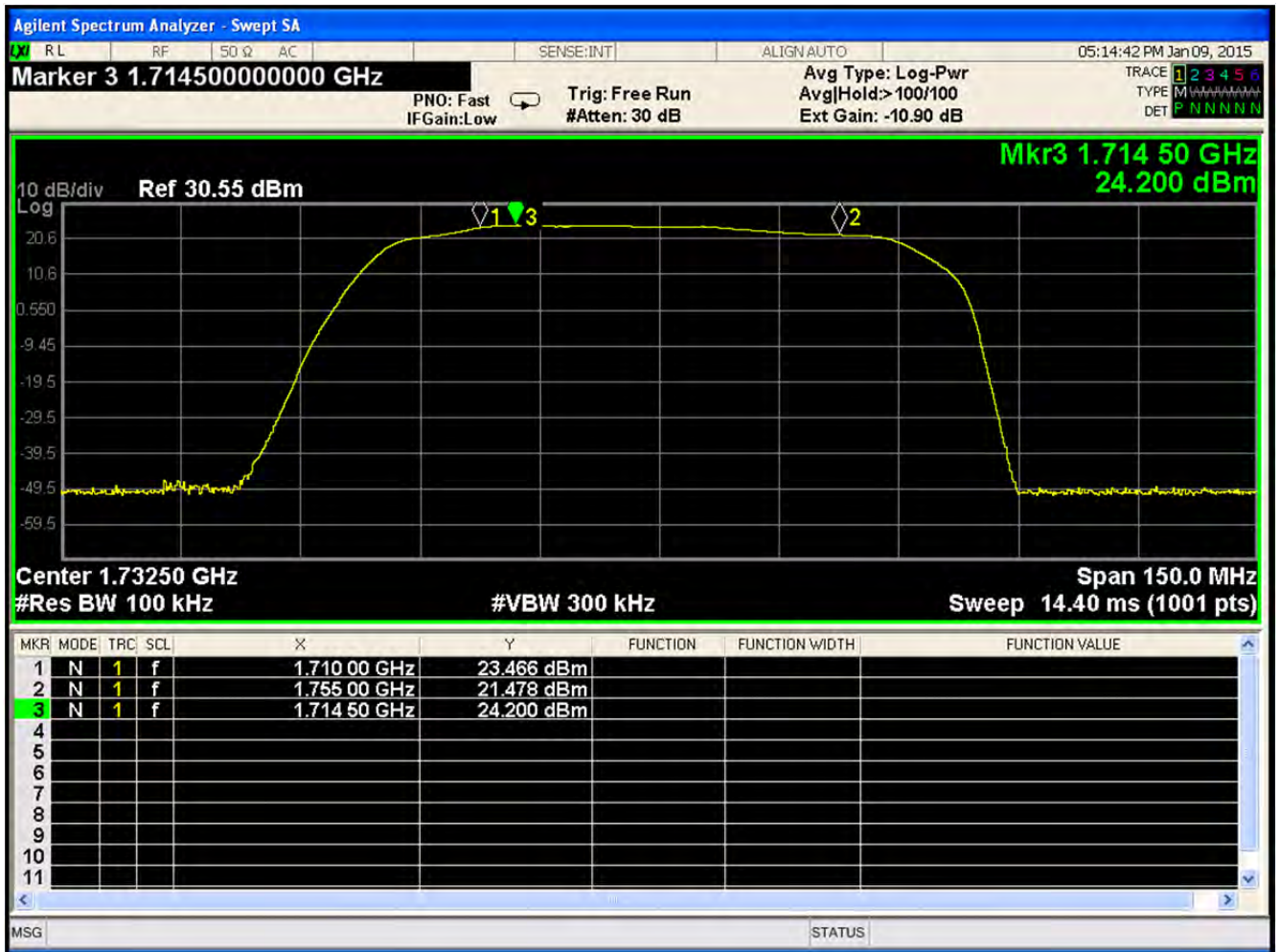
Trace mode : Max hold

Frequency of lower edge : 2110.00 MHz

Frequency of upper edge : 2155.00 MHz

Frequency of highest power : 2121.70 MHz

• Band 4 / Uplink



RBW : 100 kHz

VBW : 300 kHz

Detector mode : Peak

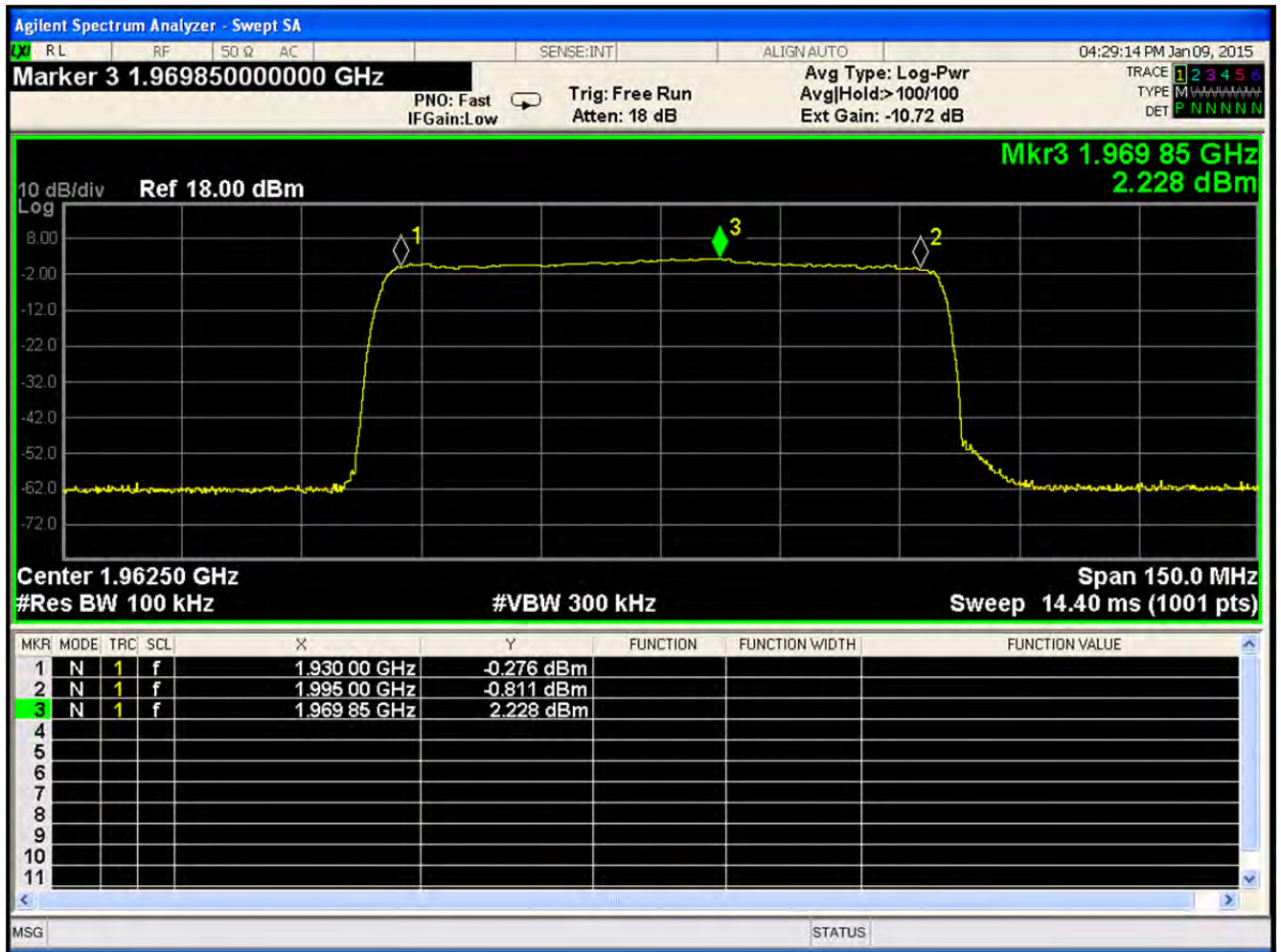
Trace mode : Max hold

Frequency of lower edge : 1710.00 MHz

Frequency of upper edge : 1755.00 MHz

Frequency of highest power : 1714.50 MHz

• Band 25/ Downlink



RBW : 100 kHz

VBW : 300 kHz

Detector mode : Peak

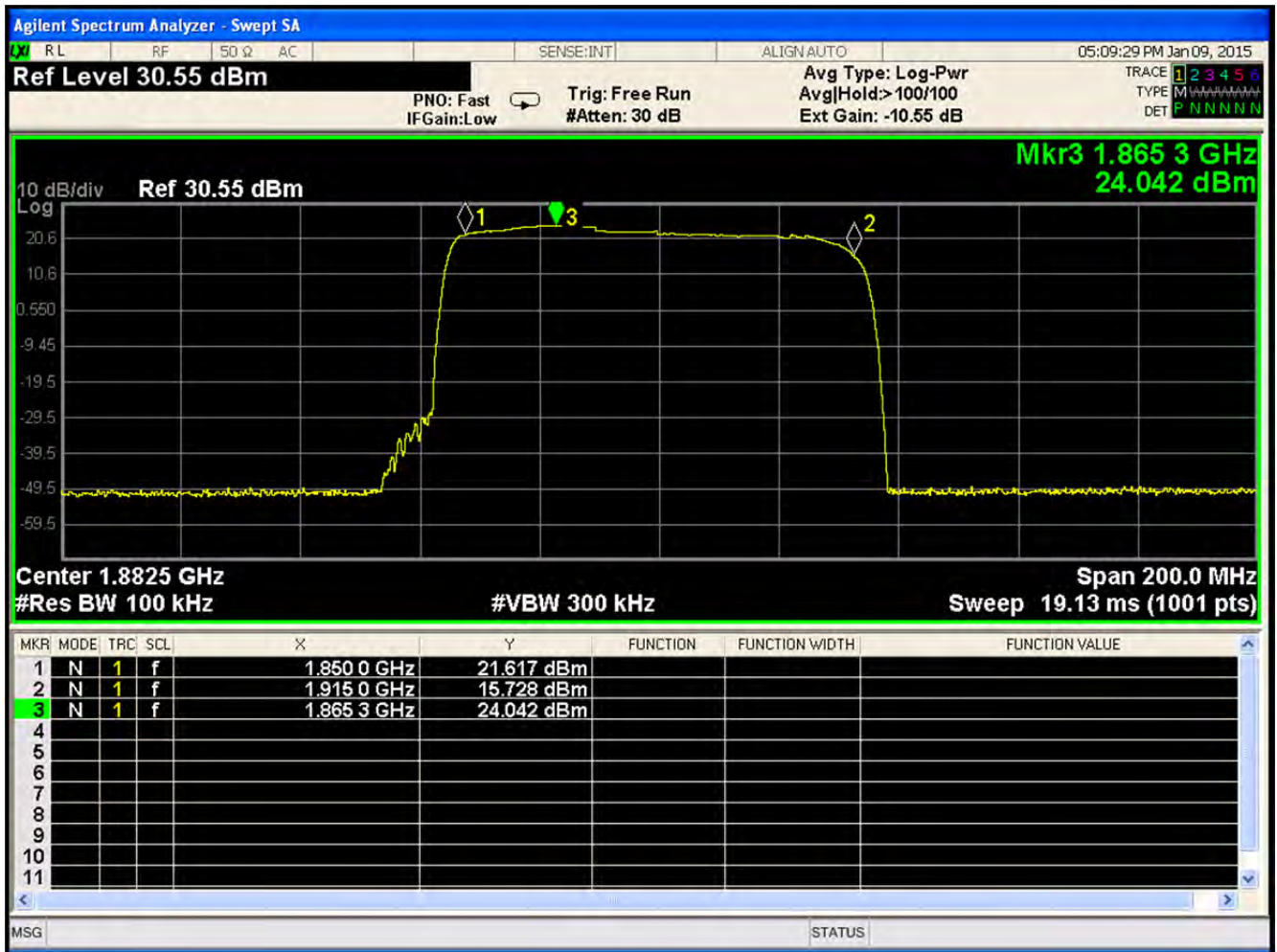
Trace mode : Max hold

Frequency of lower edge : 1930.00 MHz

Frequency of upper edge : 1995.00 MHz

Frequency of highest power : 1969.85 MHz

• Band 25/ Uplink



RBW : 100 kHz

VBW : 300 kHz

Detector mode : Peak

Trace mode : Max hold

Frequency of lower edge : 1850.00 MHz

Frequency of upper edge : 1915.00 MHz

Frequency of highest power : 1865.30 MHz

3.2 Maximum power measurement

3.2.1 Specification

- FCC Part 20.21 (e)(8)(i)(B)
- FCC Part 20.21 (e)(8)(i)(D)

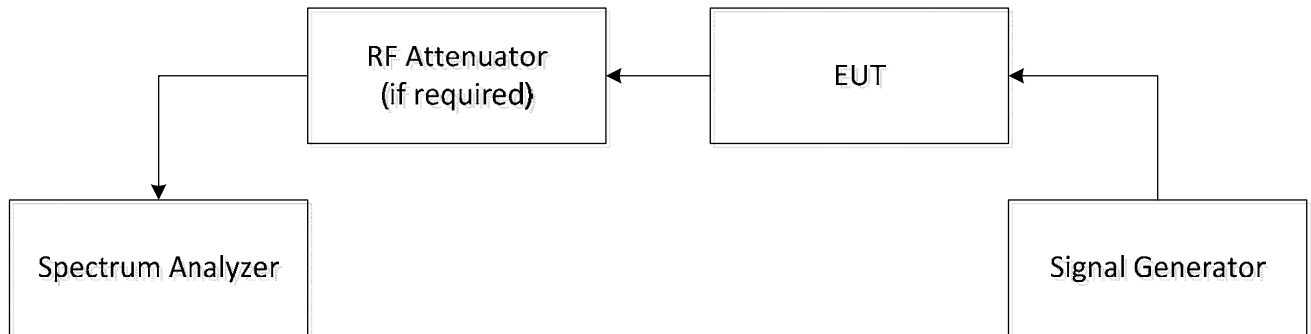
3.2.2 Measurement method

- 935210 D03 Signal Booster Measurement v02r01
- a) Connect the EUT to the test equipment as shown in Set-Up. 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 Frequency Band 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 control.
 - 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; e.g., 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 (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.
 - h) Set RBW = 100 kHz for AWGN signal type and 300 kHz for CW or GSM signal type
 - i) Set VBW $\geq$ 3X RBW
 - j) Select either the BURST POWER or CHANNEL POWER measurement tool, as required for each signal type. The channel power integration bandwidth shall be 99% occupied bandwidth (4.1 MHz).
 - k) Select the RMS (power averaging) detector.
 - l) Ensure 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).
 - m) Set sweep time = auto couple, or as necessary (but no less than auto couple value).
 - n) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
 - o) Record the measured power level as P_{out} with one set of results for the GSM or CW input stimulus and another set of results for the AWGN input stimulus.
 - p) Repeat the procedure for each operational uplink and downlink frequency band supported by the booster.

3.2.3 Limit

- Uplink: Upper / 1 W (30 dBm), Lower / 50 mW (17 dBm)
- Downlink: Upper / 50 mW (17 dBm)

3.2.4 Set-Up



3.2.5 Test equipment list

Equipment	Model Name	Manufacturer
EUT	USHR-781921-5B	OPISYS Incorporated
Signal Generator	E4432B	Agilent
Signal Generator	N5182A	Agilent
Spectrum Analyzer	N9020A	Agilent
Attenuator	AF115A-09-34	Weinschel

3.2.6 Test condition

- Test place: Shield Room
- Test environment: 23.0 °C, 44 % R.H.

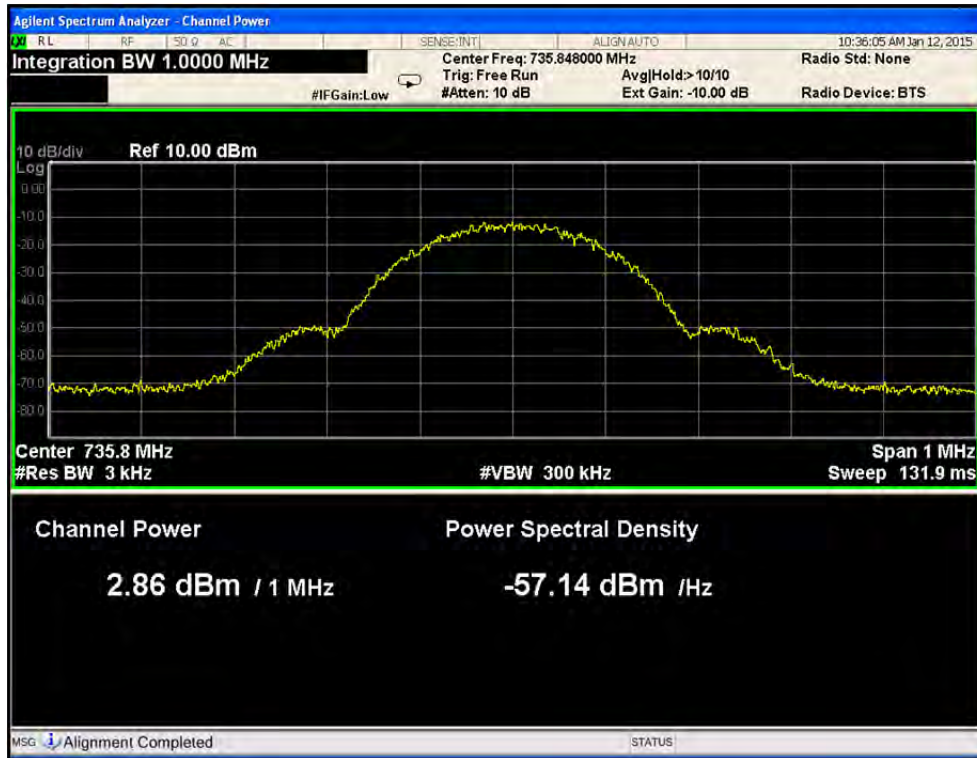
3.2.7 Test results

Band	Link	Frequency [MHz]	Signal Type	Input Level [dBm]	Output Level [dBm]	Limit [dB]
Band 12	Downlink	735.848	GSM	-58.0	2.86	Less than +17.0
			CDMA	-58.0	2.66	
			AWGN	-58.0	2.29	
			LTE	-58.0	2.25	
	Uplink	700.700	GSM	-37.0	23.01	Between +17.0 and +30.0
			CDMA	-37.0	23.08	
			AWGN	-37.0	23.06	
			LTE	-37.0	23.08	
Band 13	Downlink	749.556	GSM	-58.0	2.01	Less than +17.0
			CDMA	-58.0	2.05	
			AWGN	-58.0	2.00	
			LTE	-58.0	2.02	
	Uplink	777.300	GSM	-38.0	23.08	Between +17.0 and +30.0
			CDMA	-38.0	23.00	
			AWGN	-38.0	23.01	
			LTE	-38.0	23.07	
Band 5	Downlink	875.900	GSM	-60.0	2.41	Less than +17.0
			CDMA	-60.0	2.58	
			AWGN	-60.0	2.59	
			LTE	-60.0	2.21	
	Uplink	834.680	GSM	-38.0	23.05	Between +17.0 and +30.0
			CDMA	-38.0	23.00	
			AWGN	-38.0	23.03	
			LTE	-38.0	23.06	

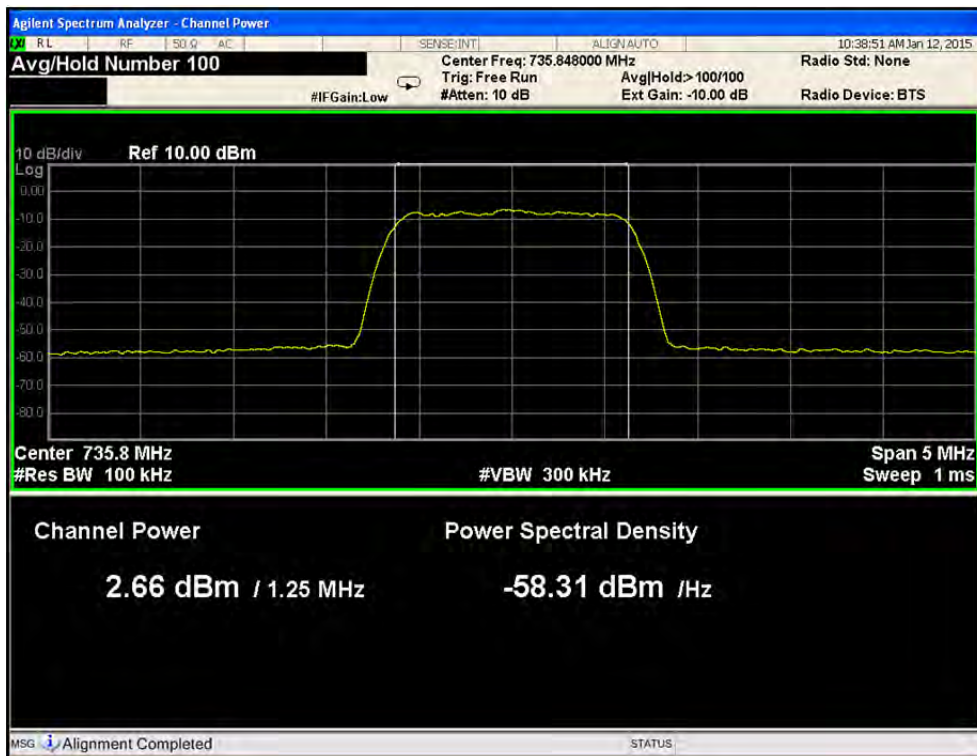
Band	Link	Frequency [MHz]	Signal Type	Input Level [dBm]	Output Level [dBm]	Limit [dB]
Band 4	Downlink	2121.70	GSM	-68.0	2.38	Less than +17.0
			CDMA	-68.0	2.25	
			AWGN	-68.0	2.33	
			LTE	-68.0	2.44	
	Uplink	1714.50	GSM	-45.0	23.30	Between +17.0 and +30.0
			CDMA	-45.0	23.16	
			AWGN	-45.0	23.39	
			LTE	-45.0	23.35	
Band 25	Downlink	1969.85	GSM	-67.0	2.41	Less than +17.0
			CDMA	-67.0	2.26	
			AWGN	-67.0	2.25	
			LTE	-67.0	2.45	
	Uplink	1865.30	GSM	-45.0	23.39	Between +17.0 and +30.0
			CDMA	-45.0	23.16	
			AWGN	-45.0	23.12	
			LTE	-45.0	23.43	

3.2.8 Test Plots

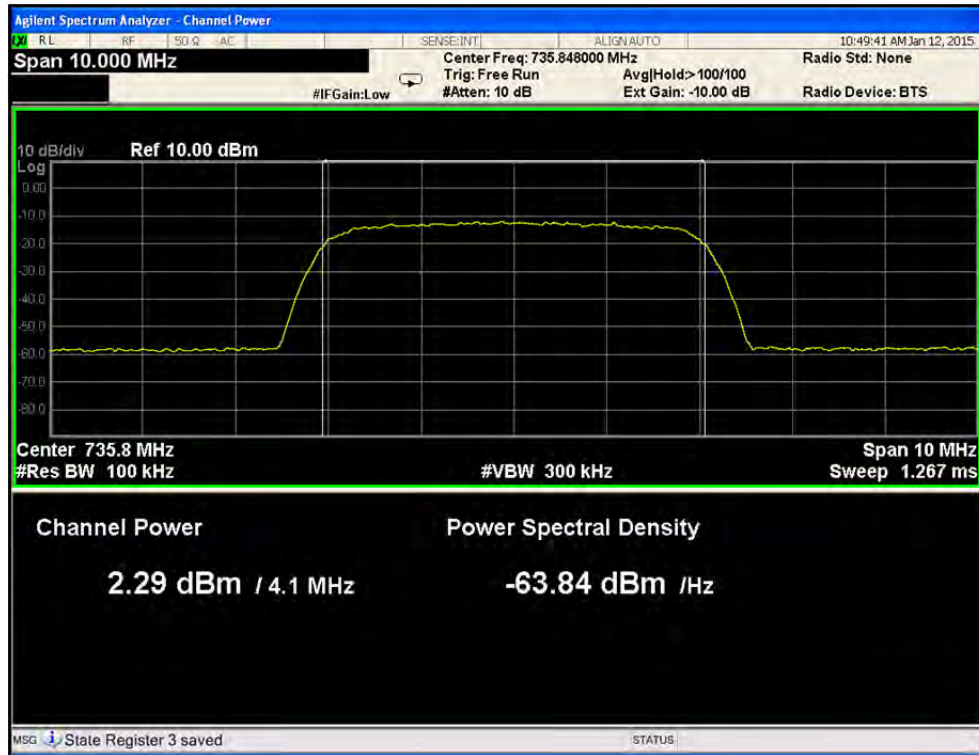
- Band 12 / Downlink / GSM



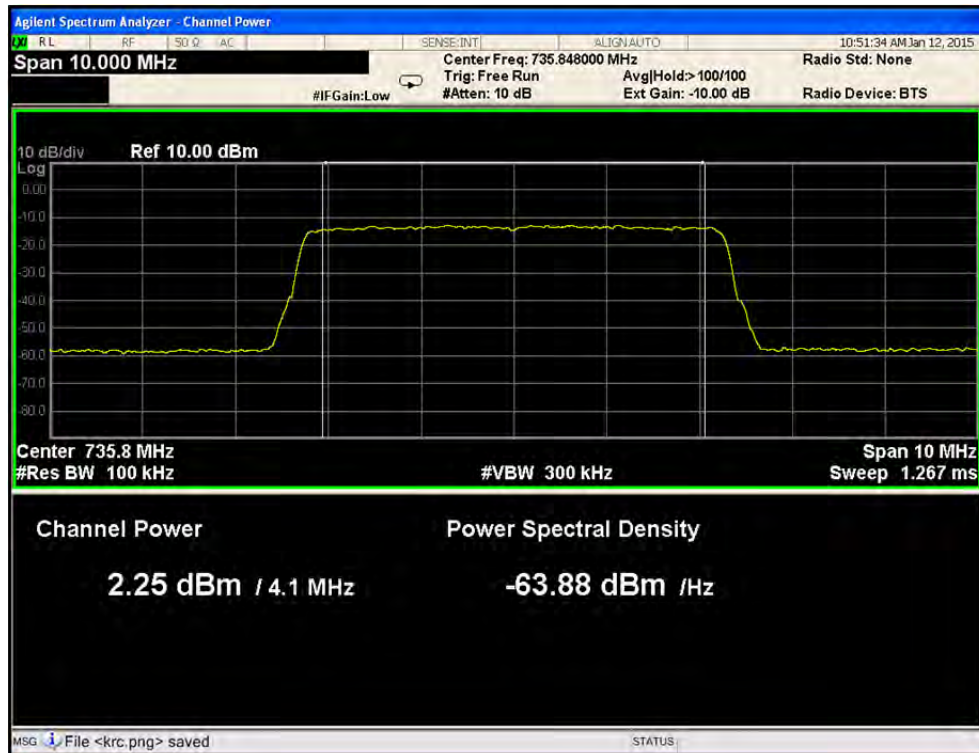
- Band 12 / Downlink / CDMA



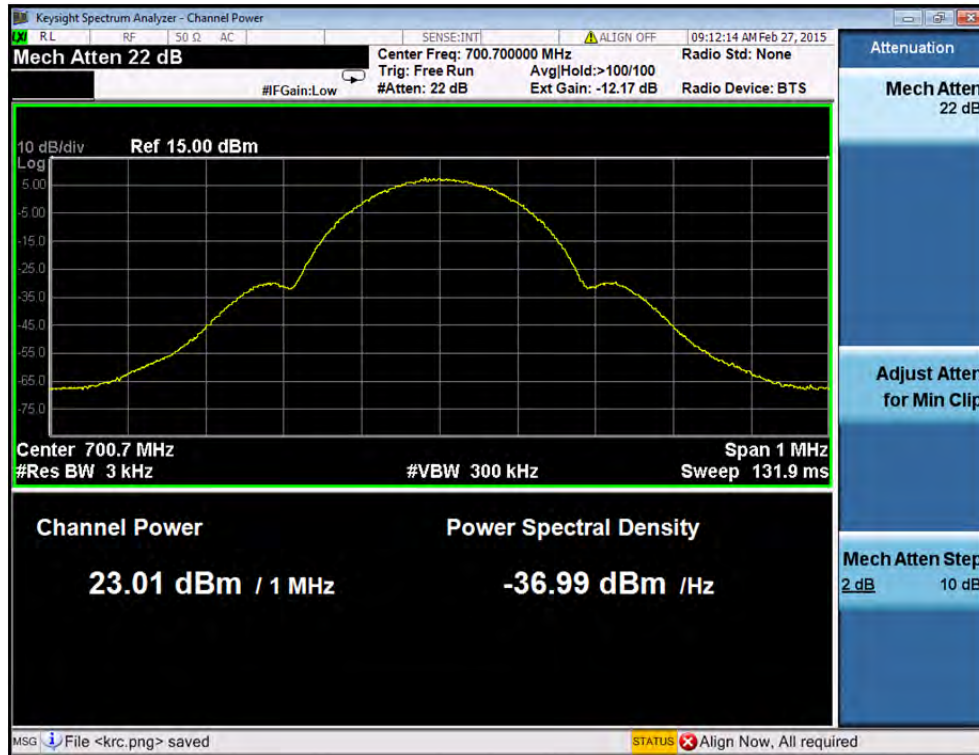
• Band 12 / Downlink / AWGN



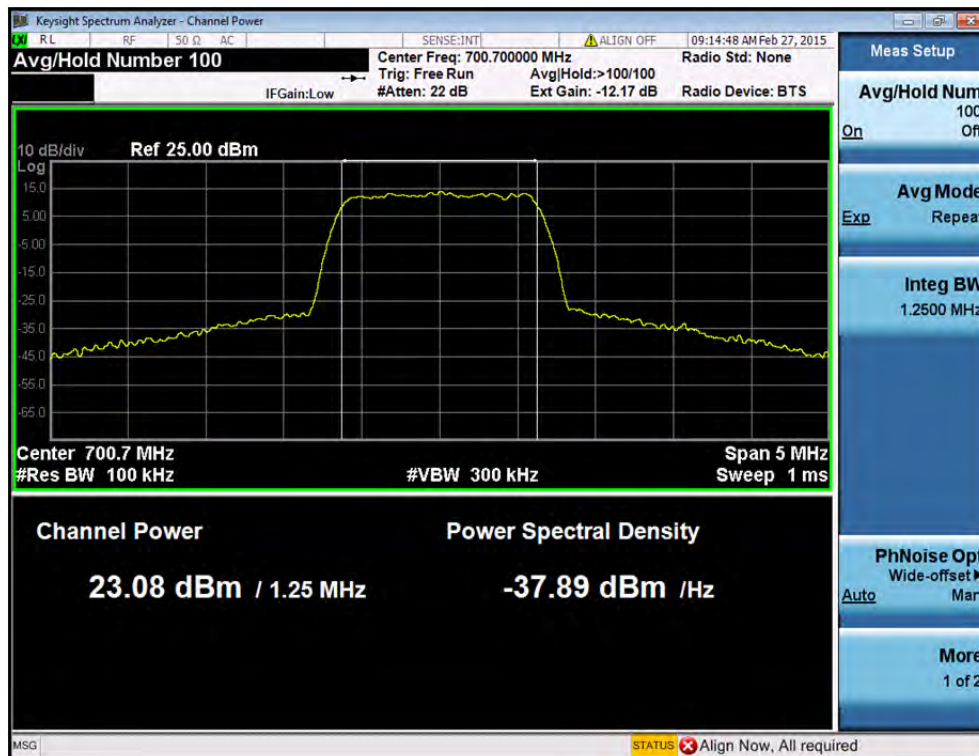
• Band 12 / Downlink / LTE



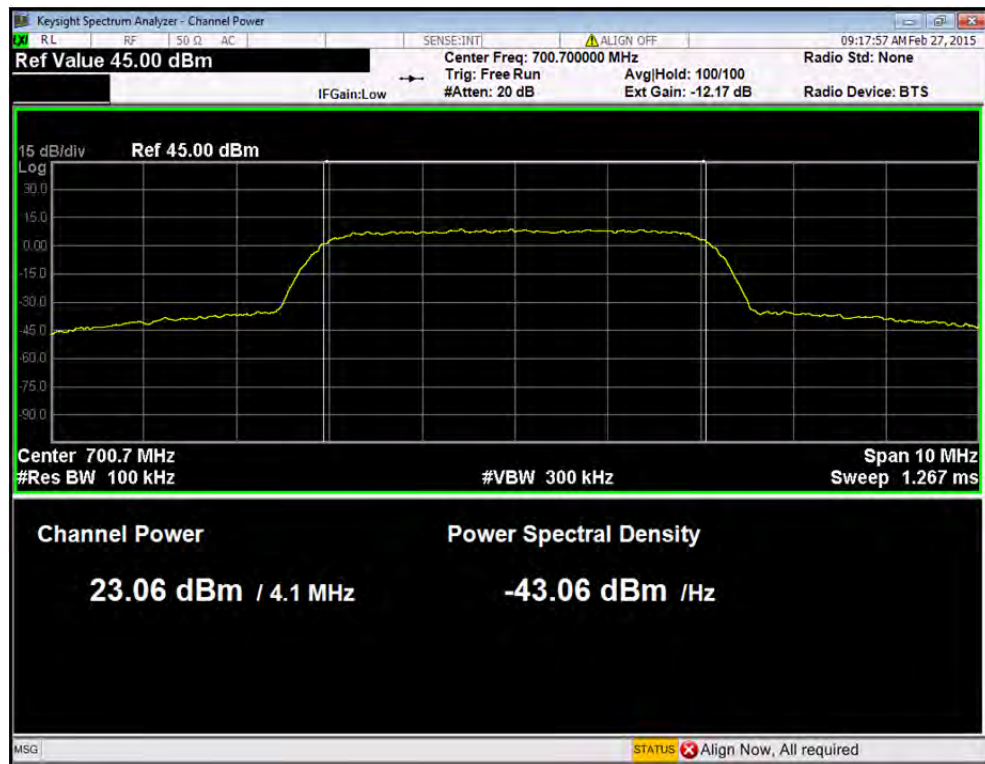
• Band 12 / Uplink / GSM



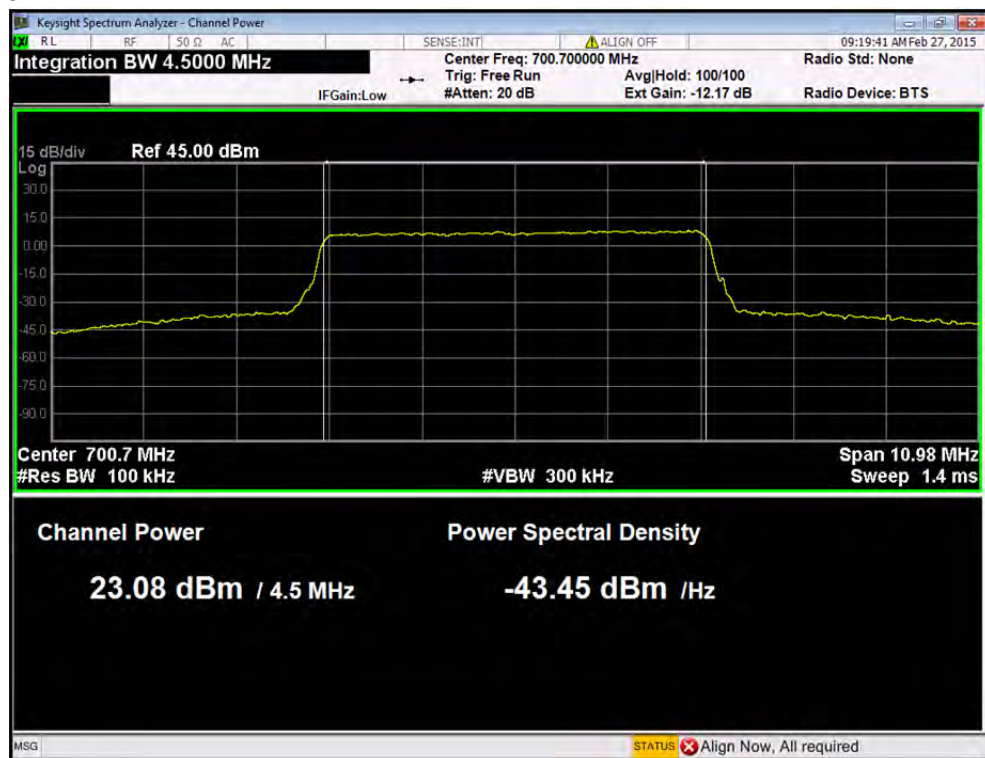
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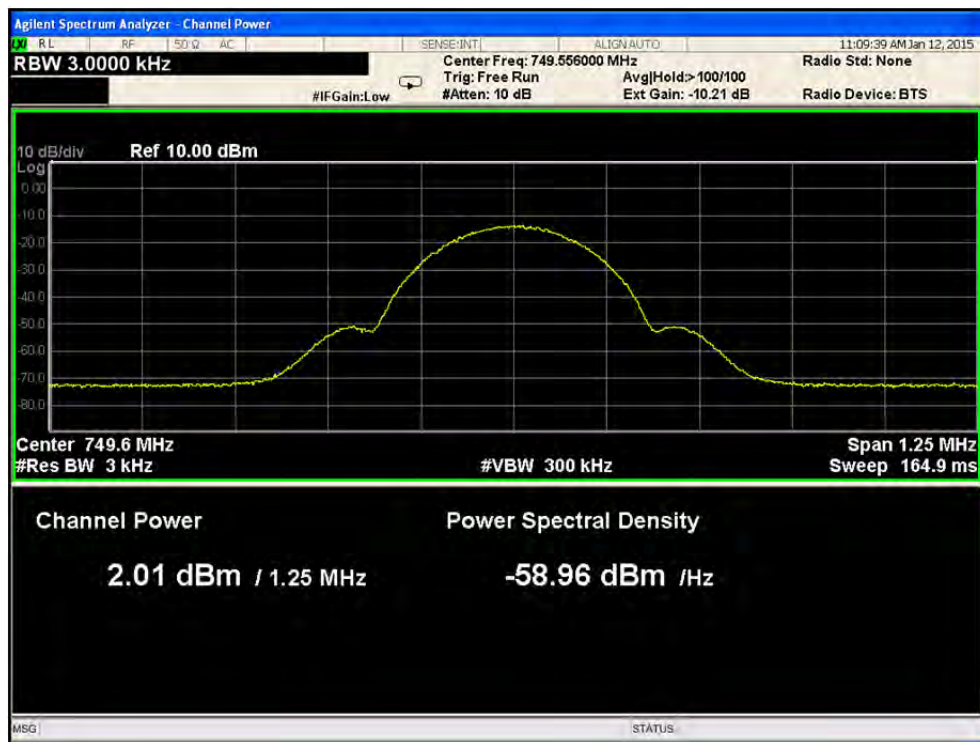
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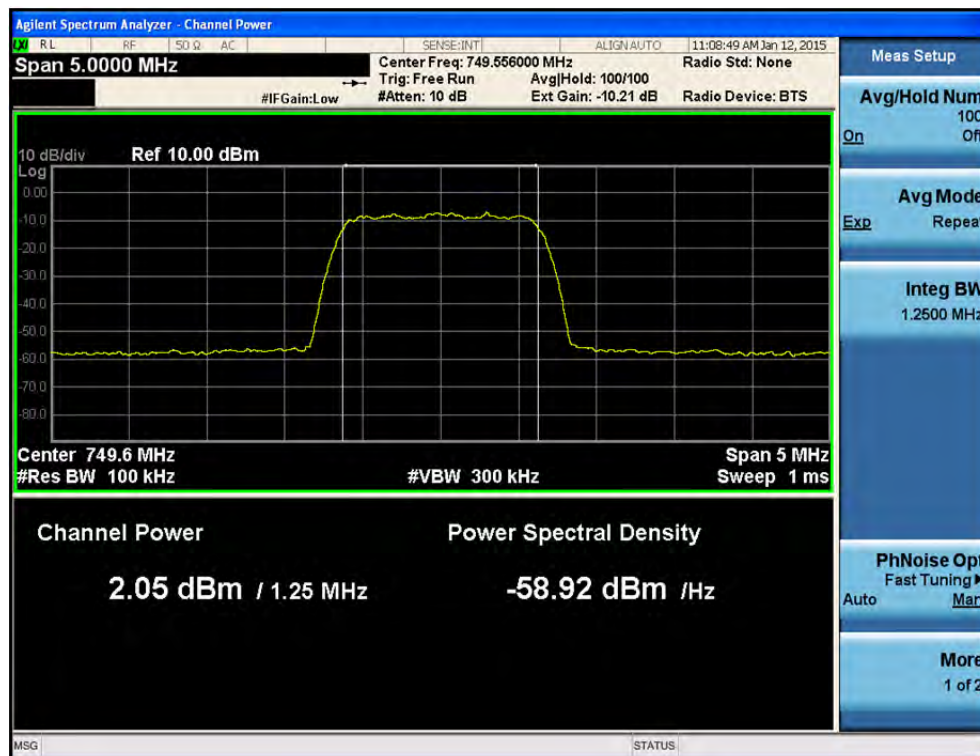
- Band 12 / Uplink / LTE



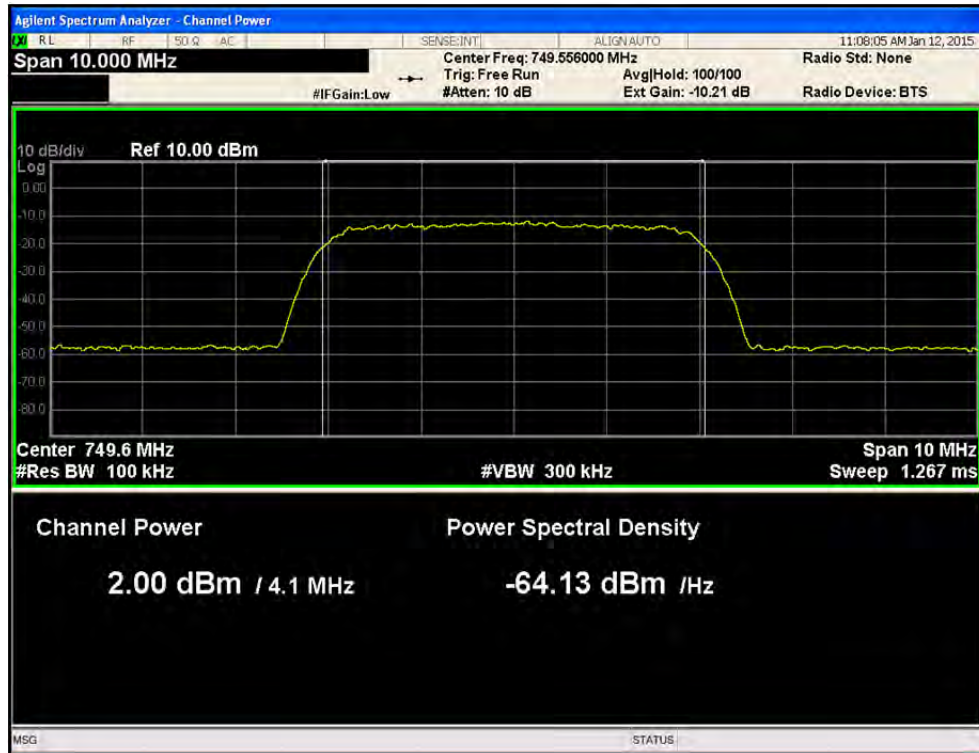
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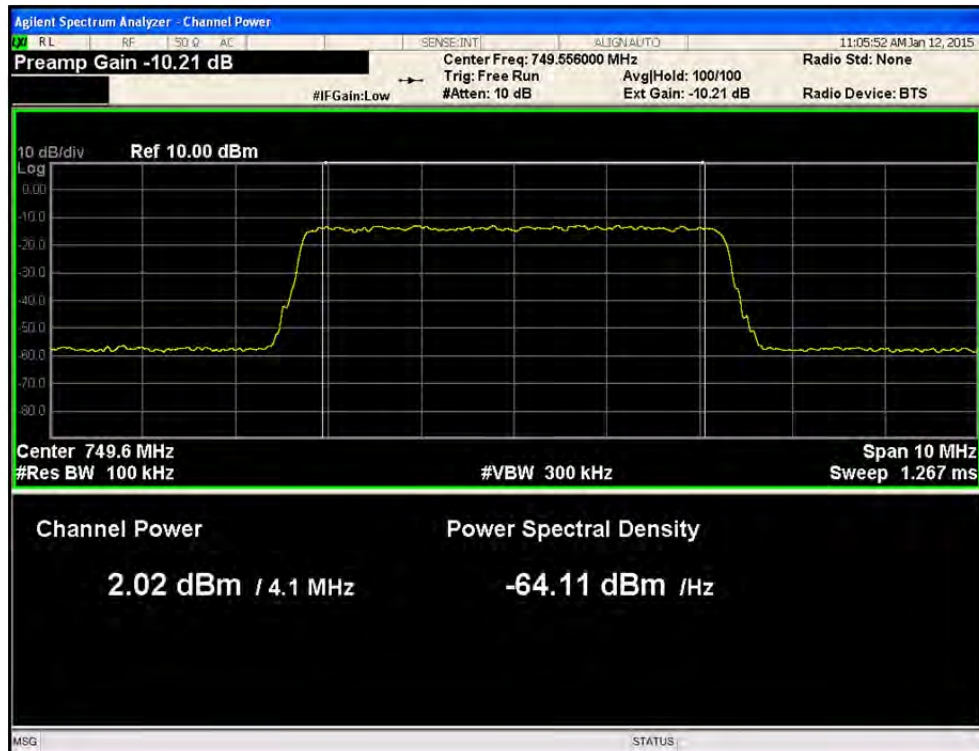
• Band 13 / Downlink / CDMA



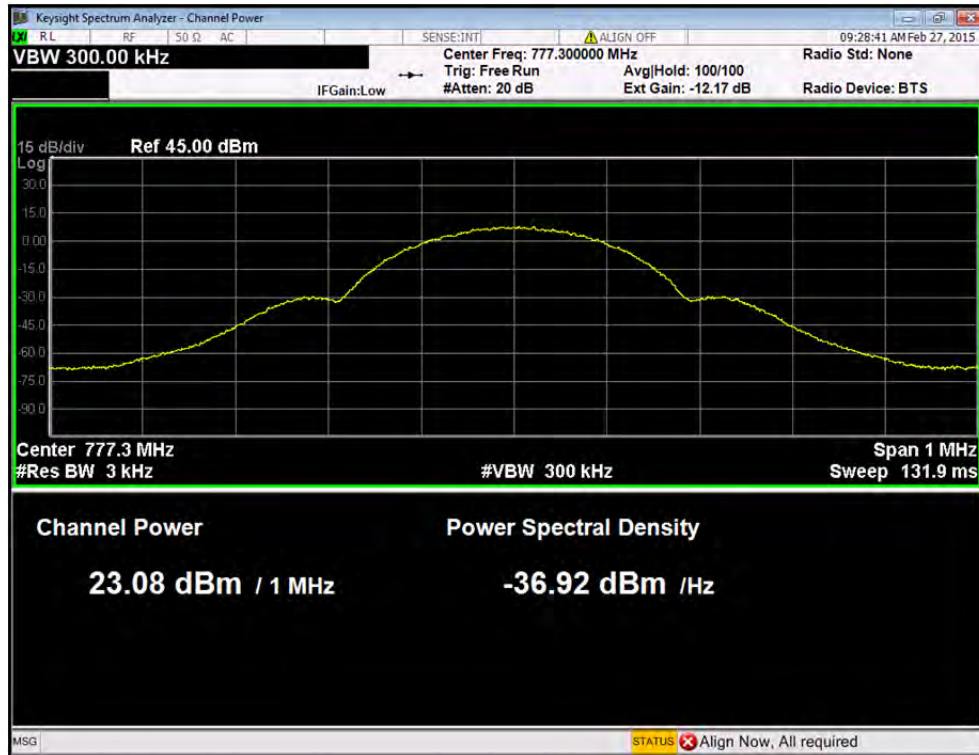
• Band 13 / Downlink / AWGN



• Band 13 / Downlink / LTE



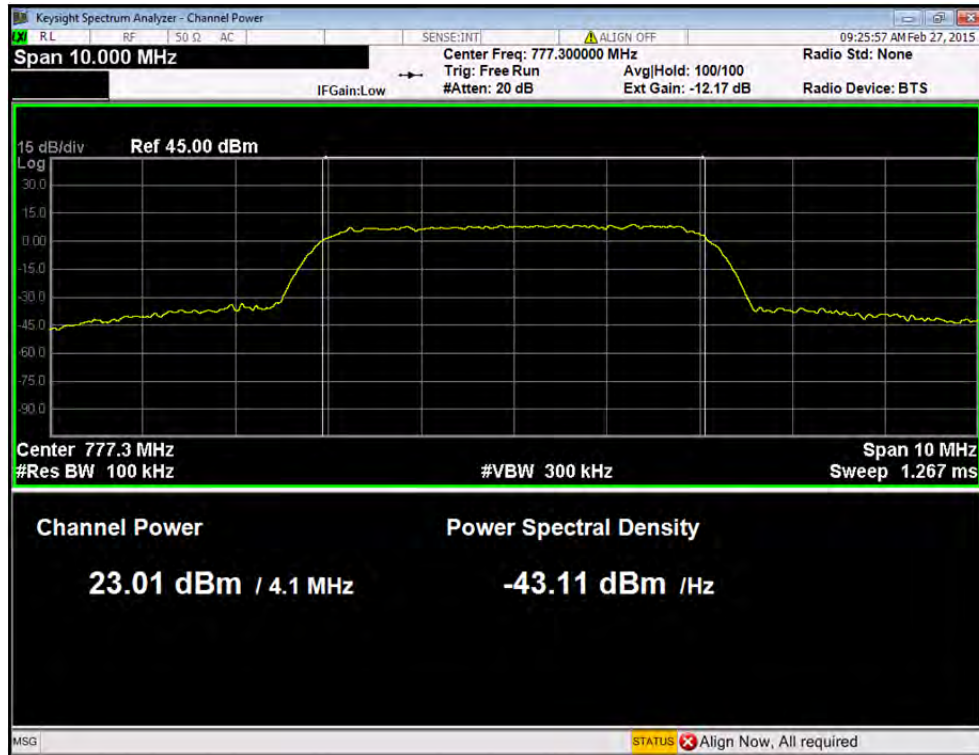
- Band 13 / Uplink / GSM



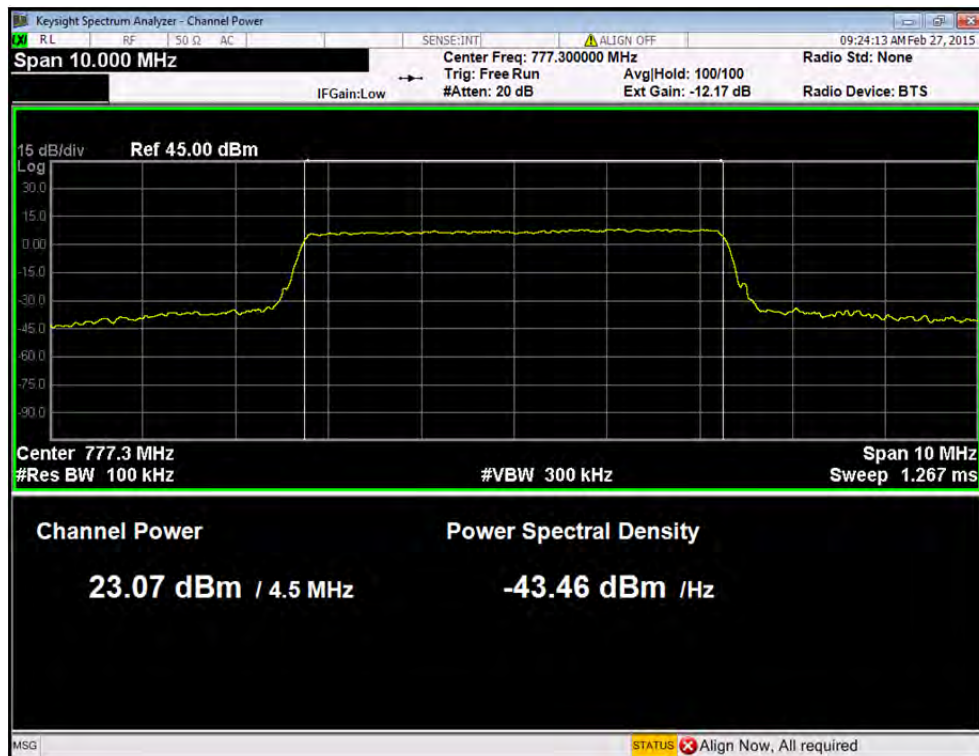
- Band 13 / Uplink / CDMA



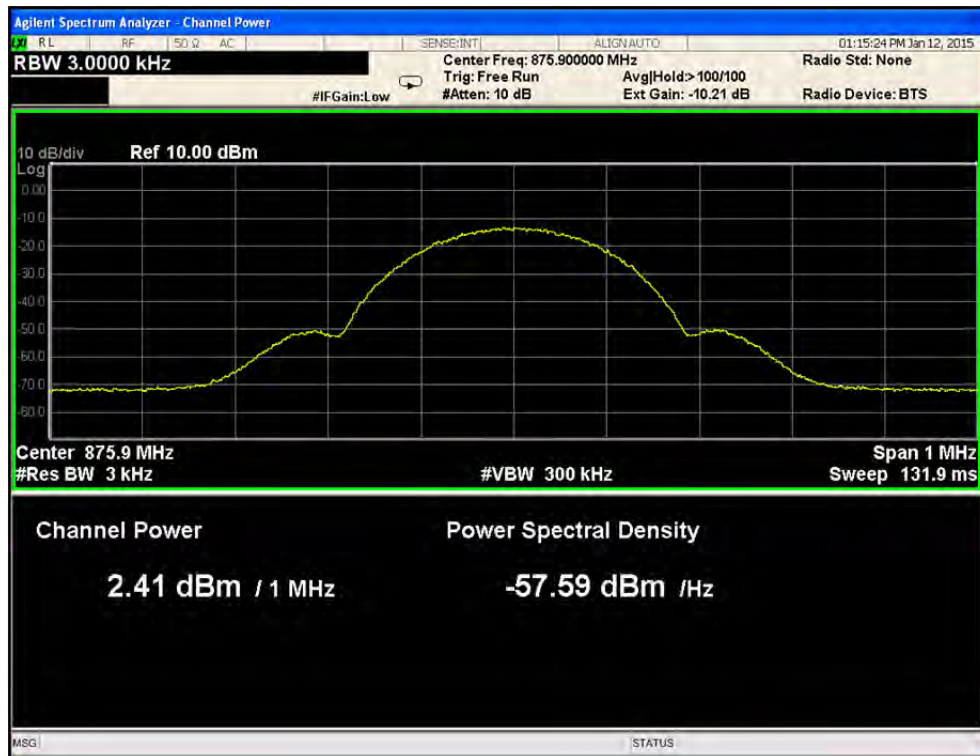
- Band 13 / Uplink / AWGN



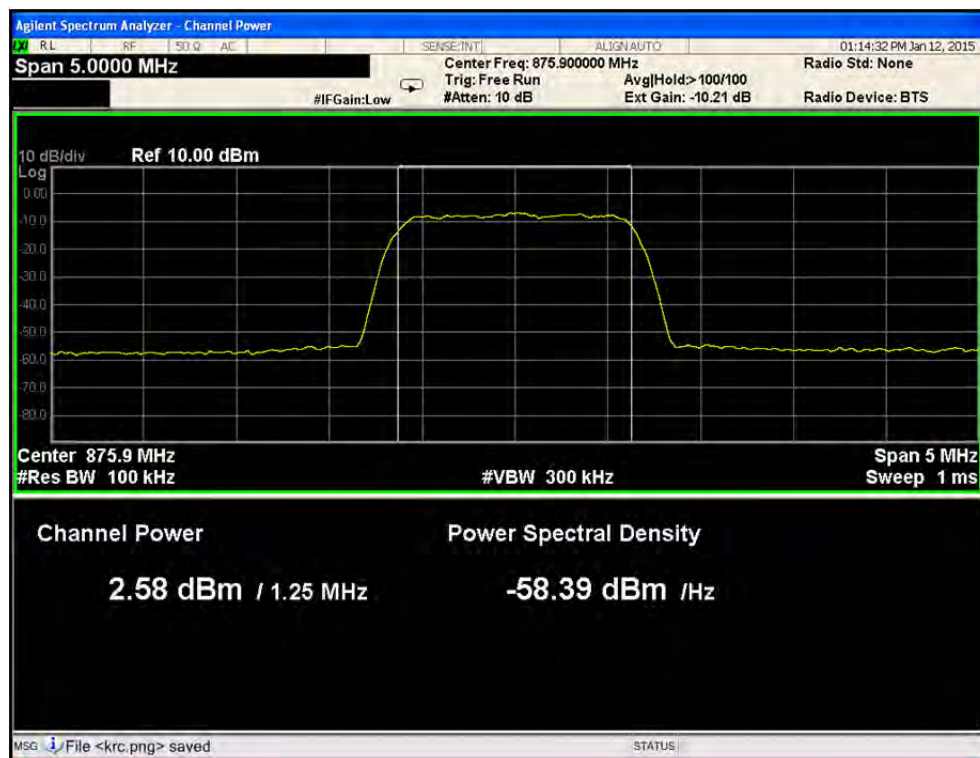
- Band 13 / Uplink / LTE



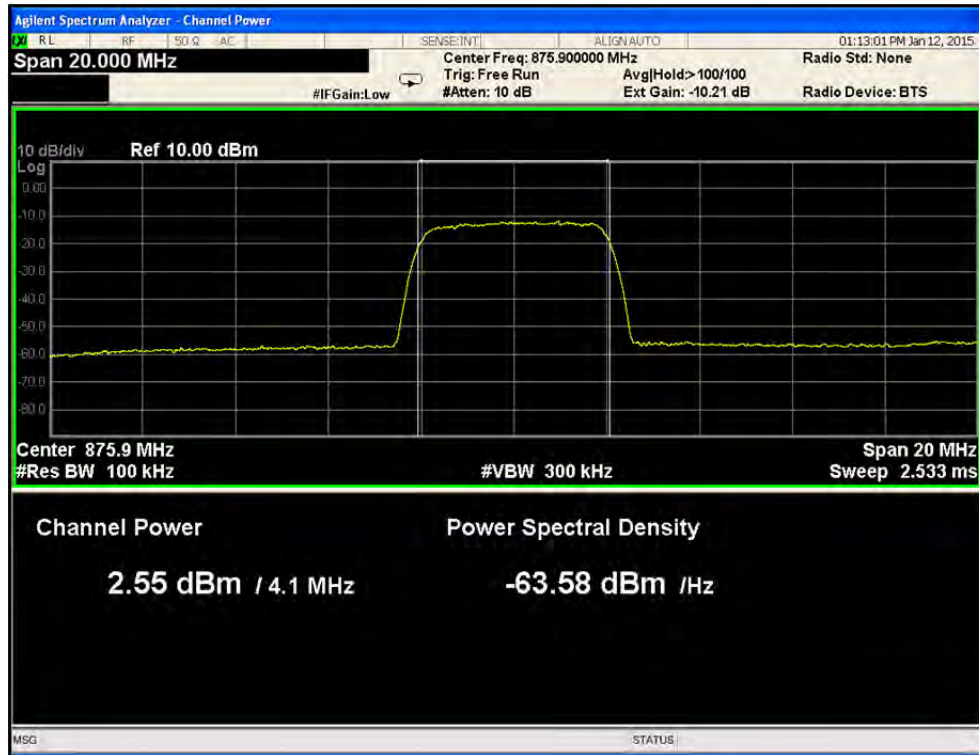
- Band 5 / Downlink / GSM



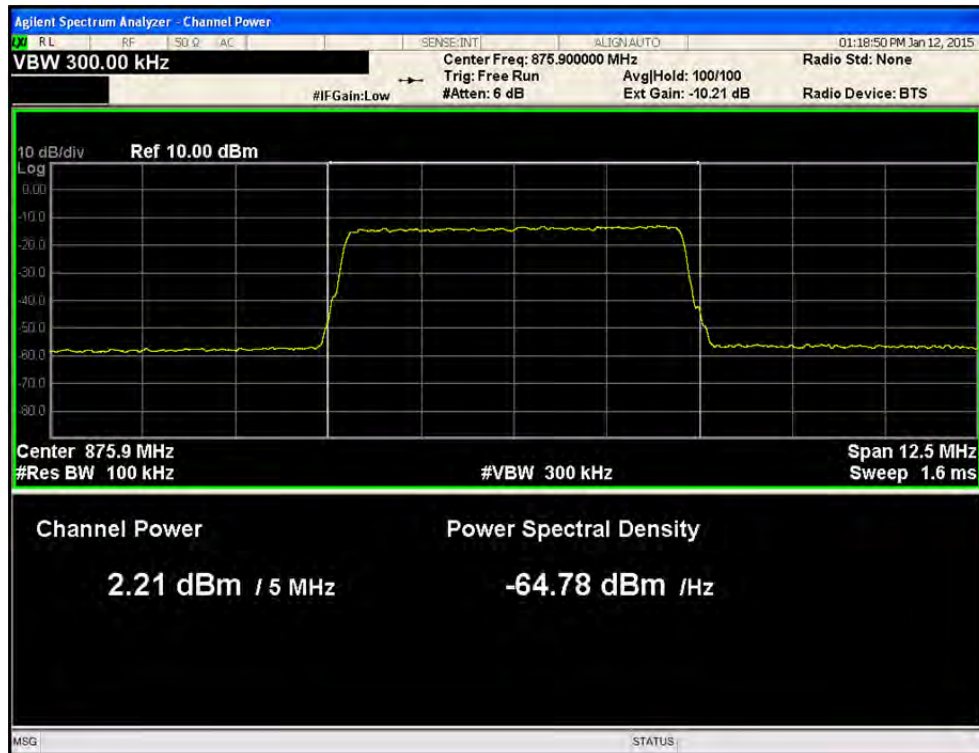
- Band 5 / Downlink / CDMA



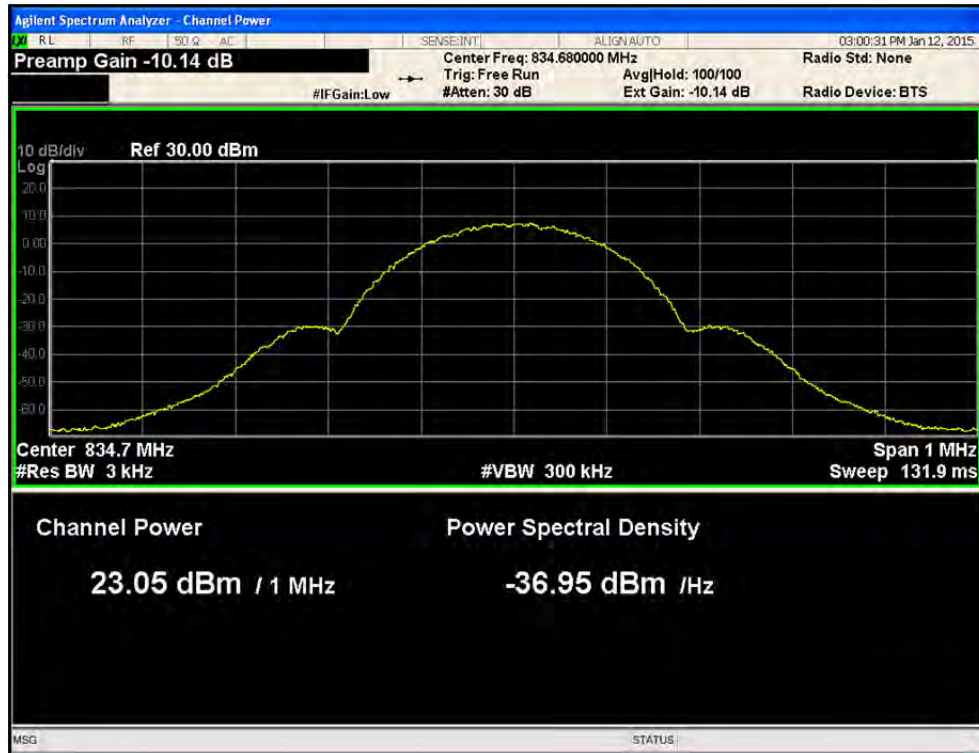
- Band 5 / Down link / AWGN



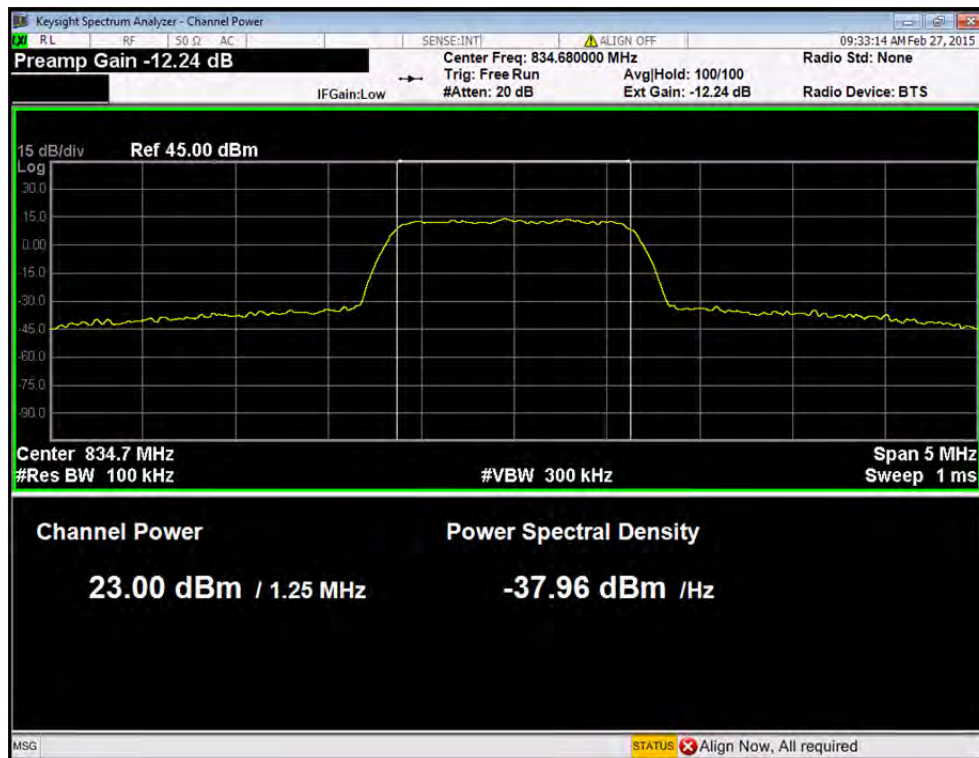
- Band 5 / Downlink / LTE



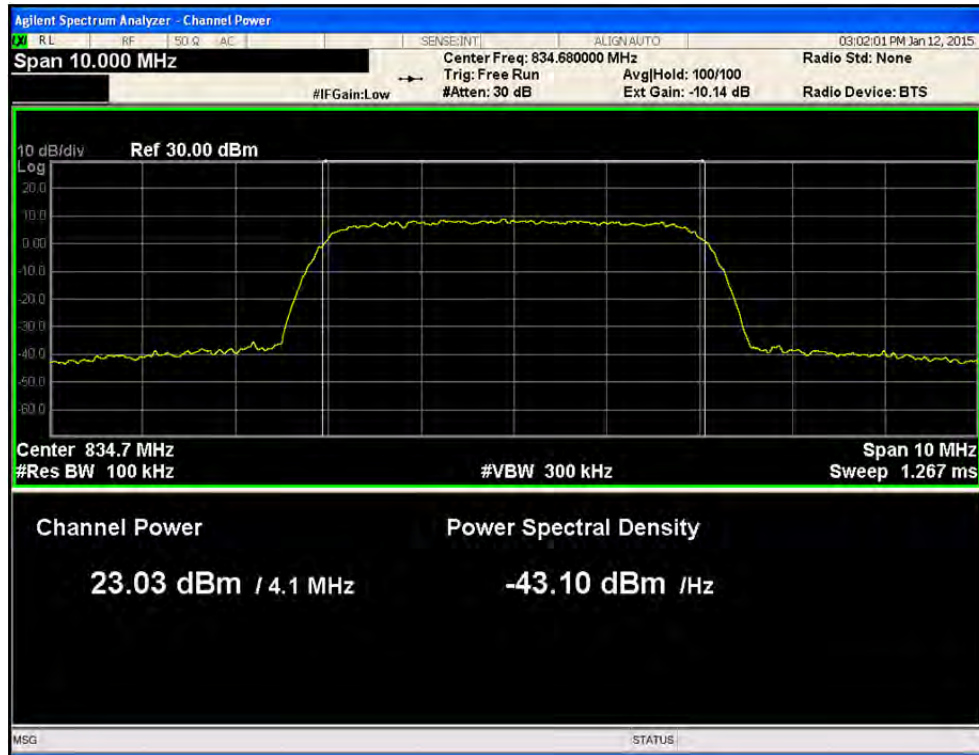
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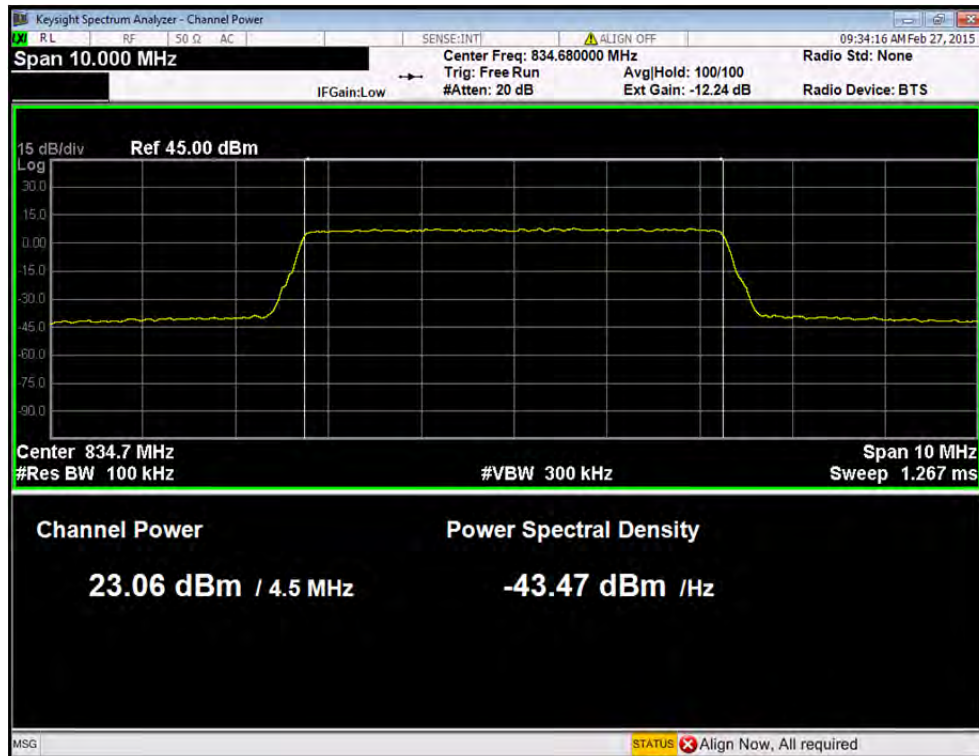
- Band 5 / Uplink / CDMA



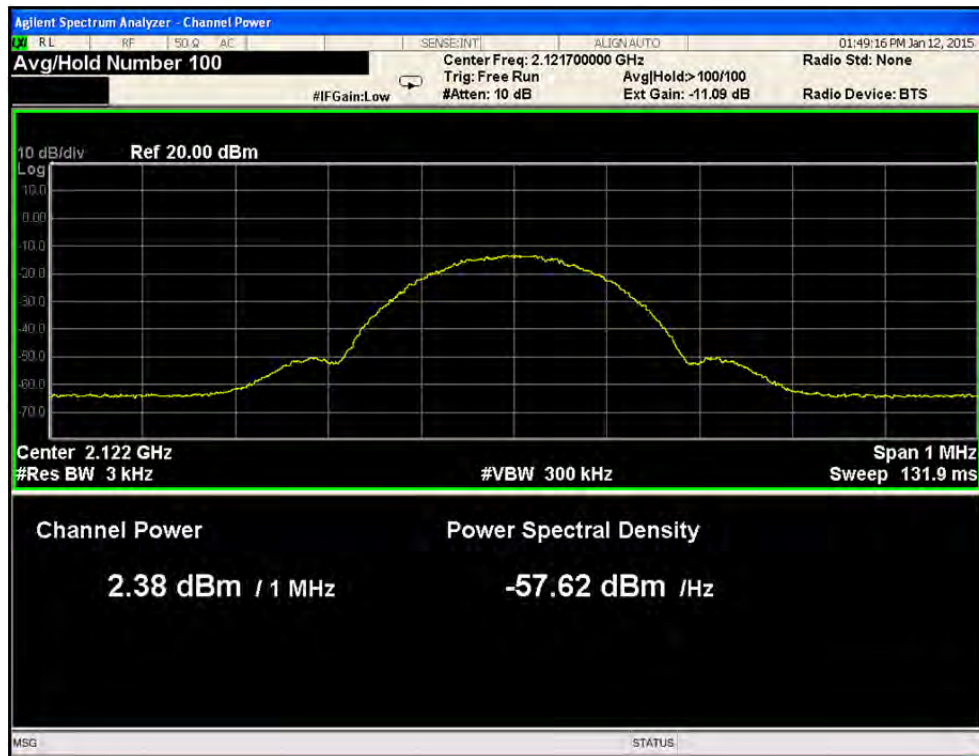
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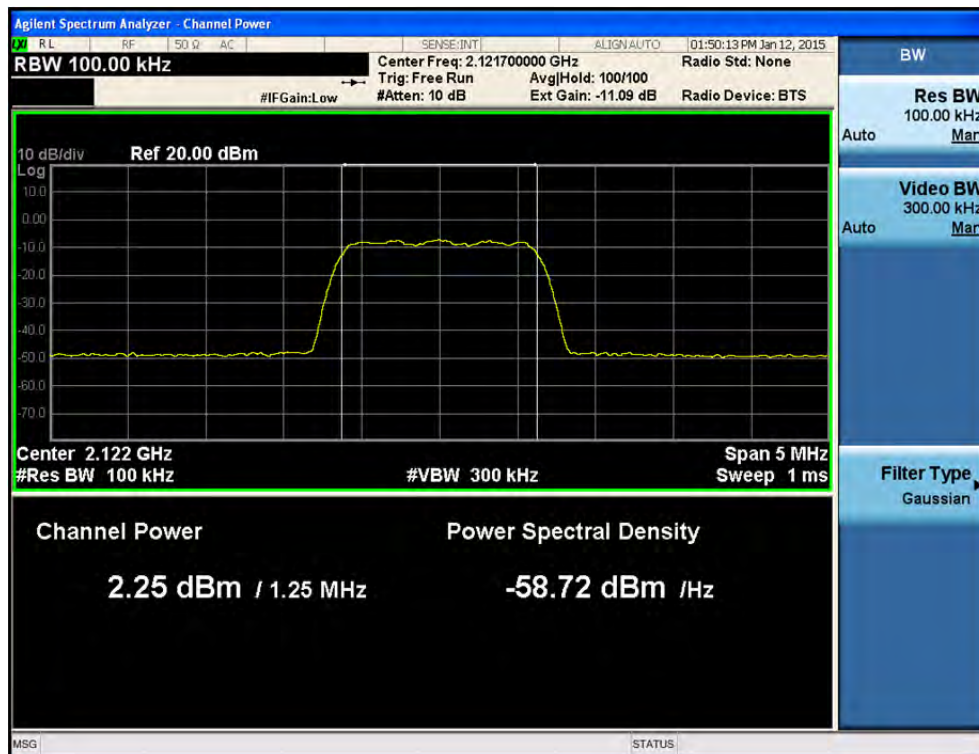
• Band 5 / Uplink / LTE



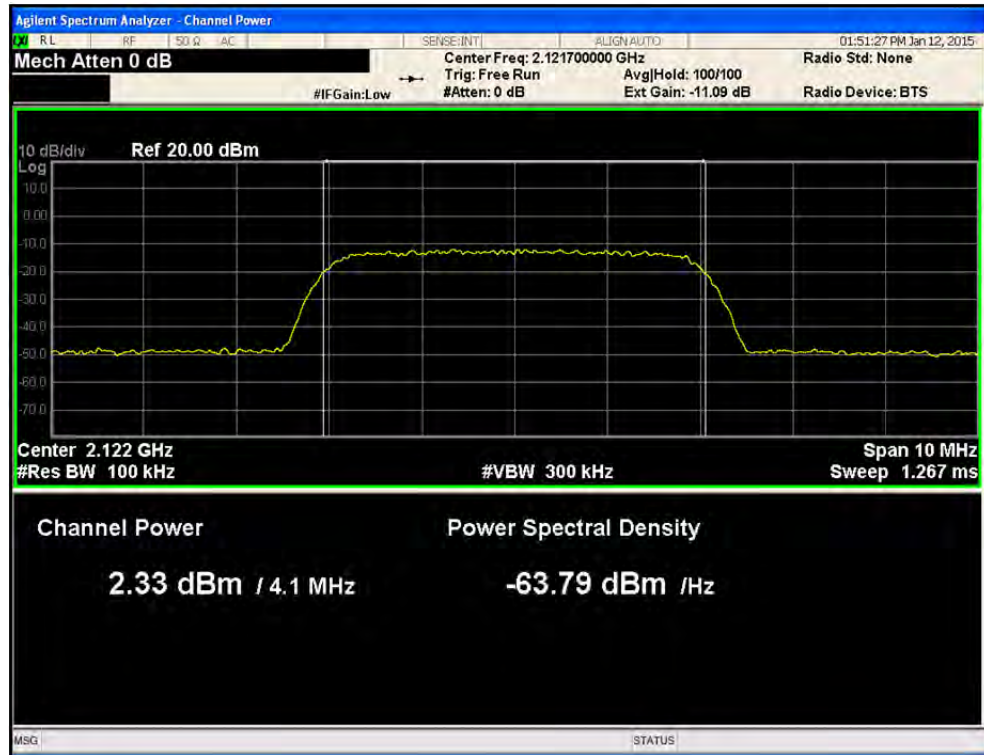
- Band 4 / Downlink / GSM



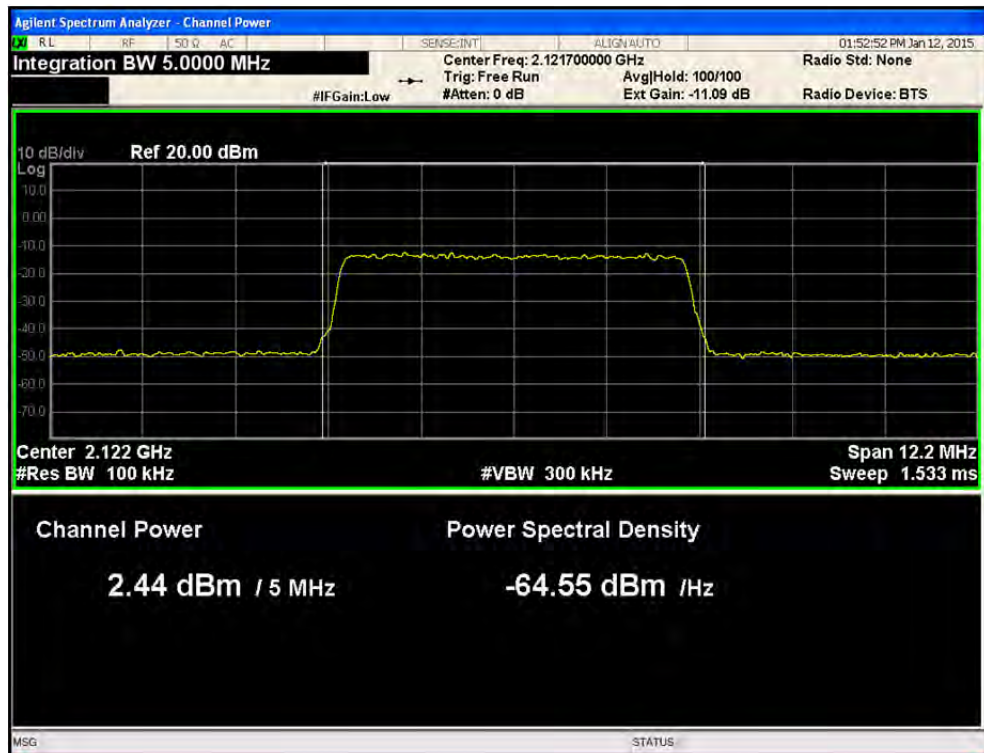
- Band 4 / Downlink / CDMA



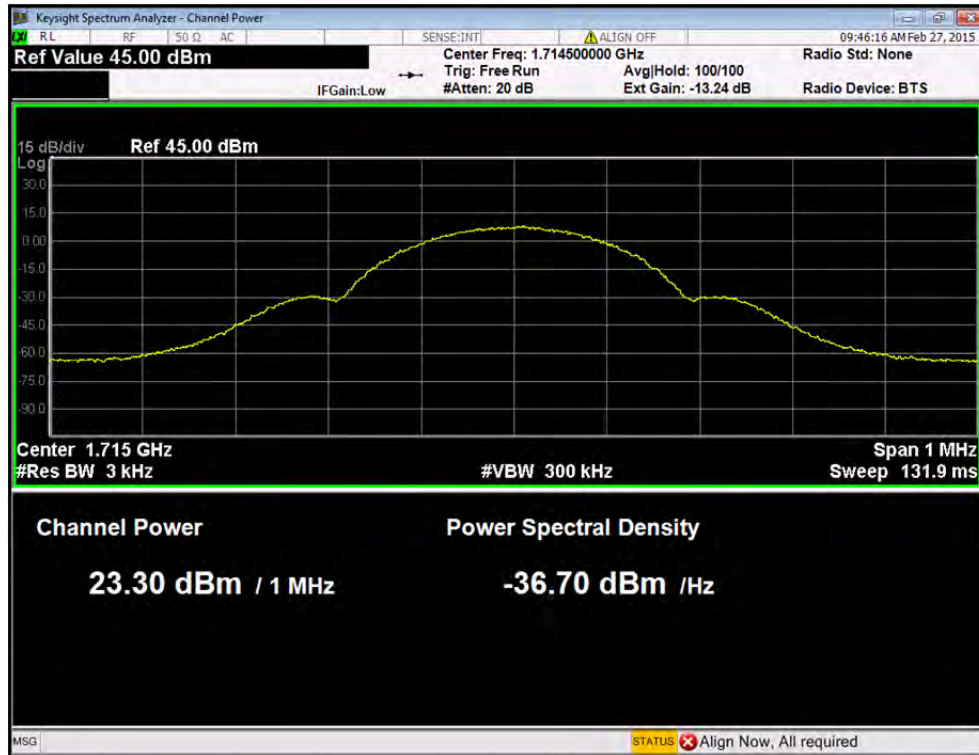
- Band 4 / Down link / AWGN



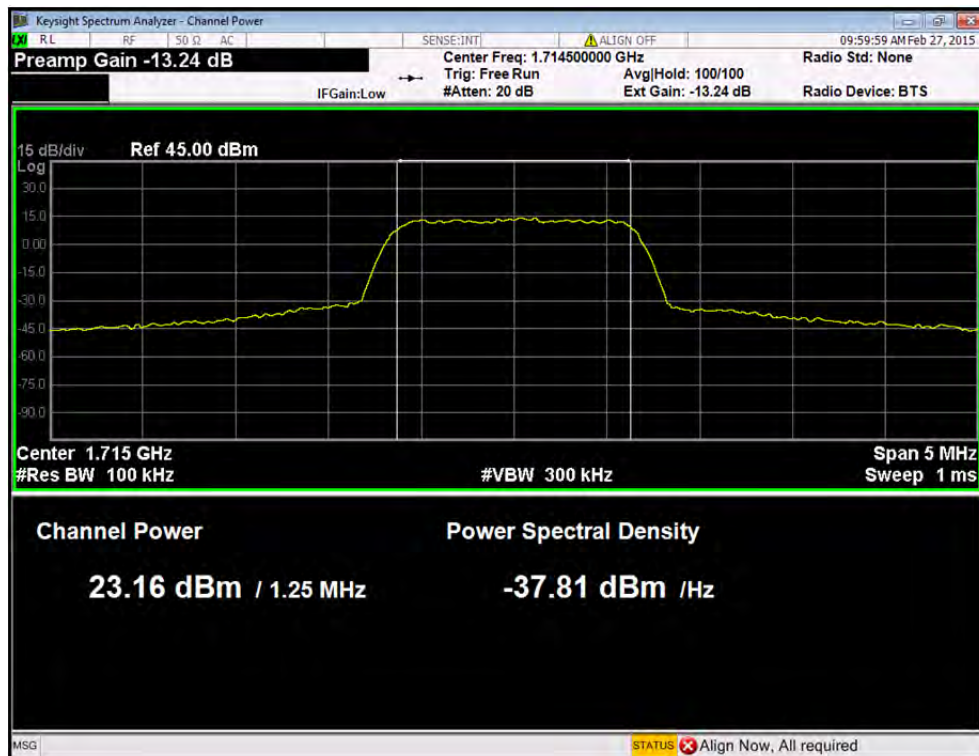
- Band 4 / Downlink / LTE



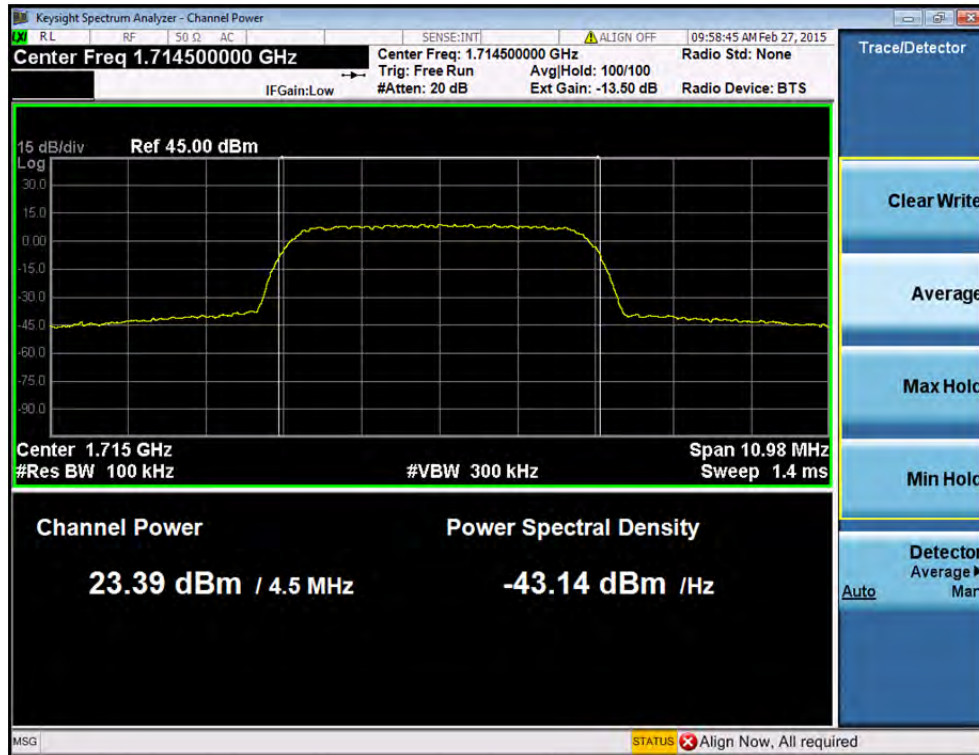
- Band 4 / Uplink / GSM



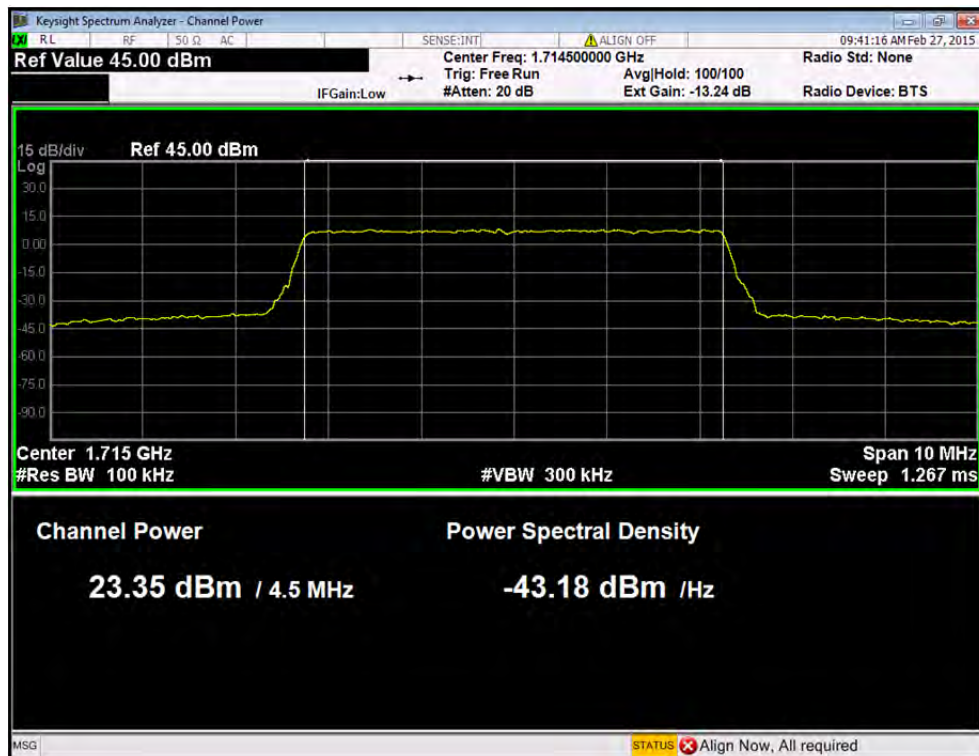
- Band 4 / Uplink / CDMA



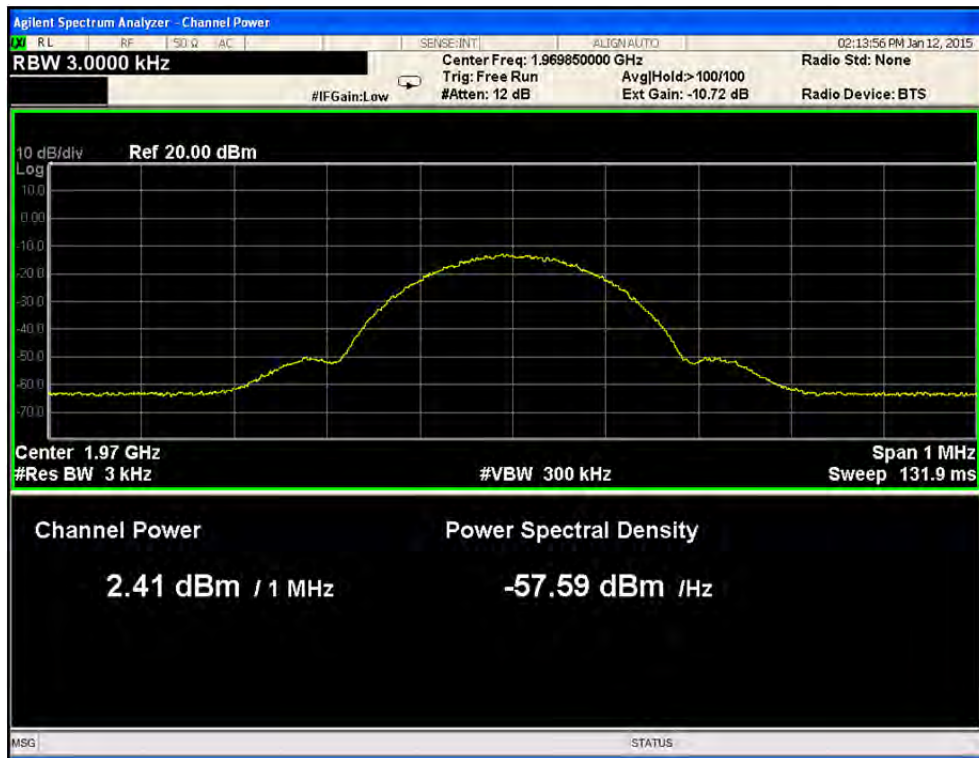
- Band 4 / Uplink / AWGN



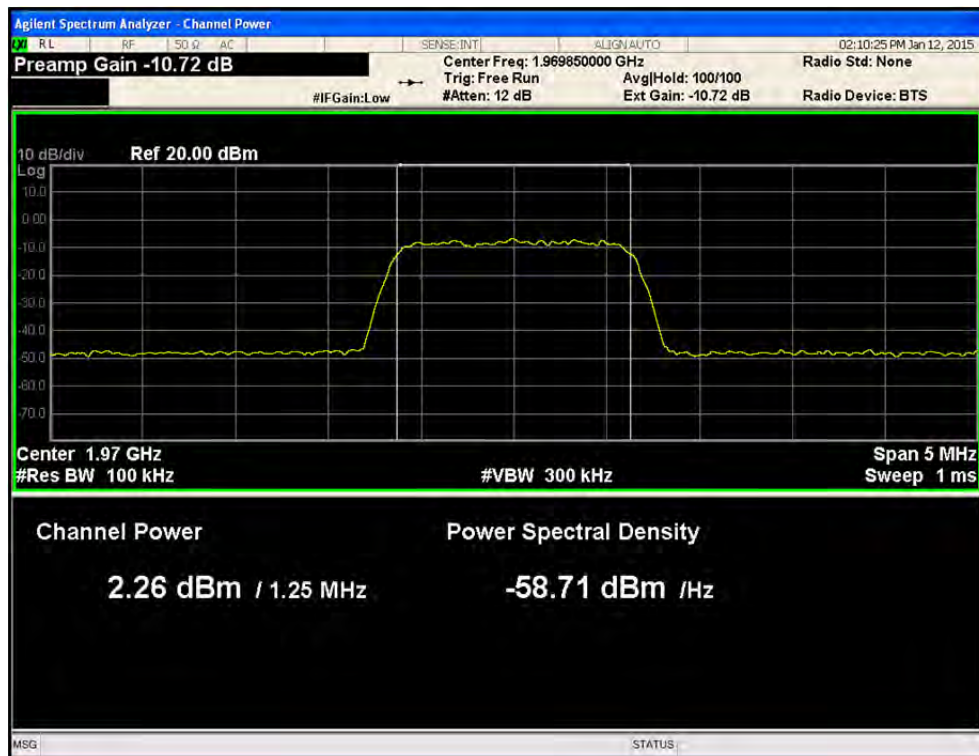
- Band 4 / Uplink / LTE



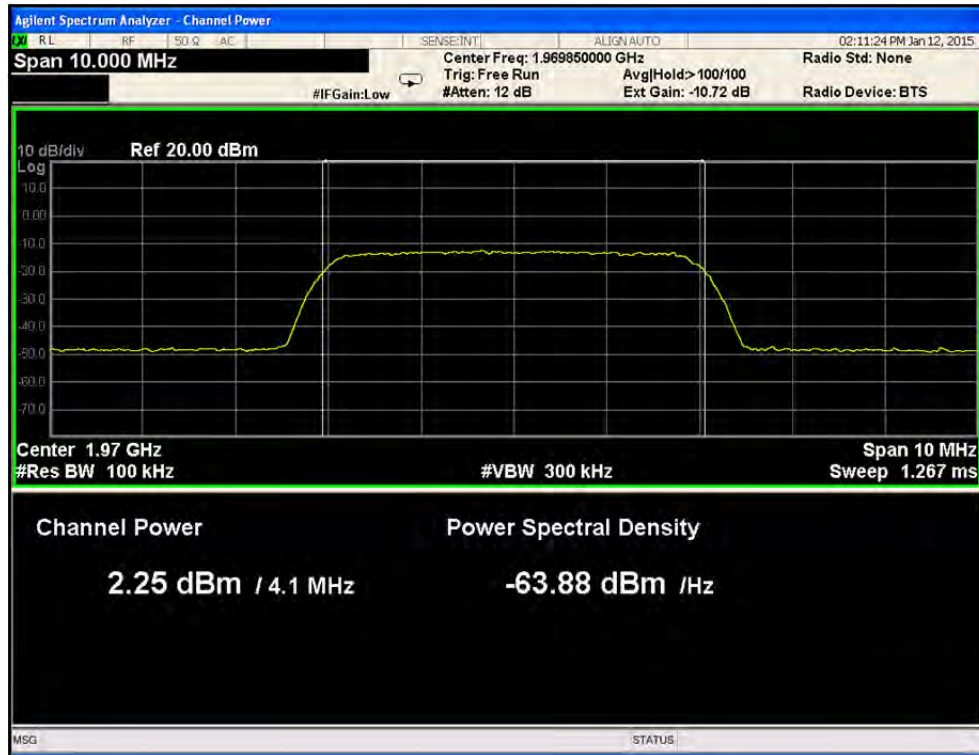
- Band 25/ Downlink / GSM



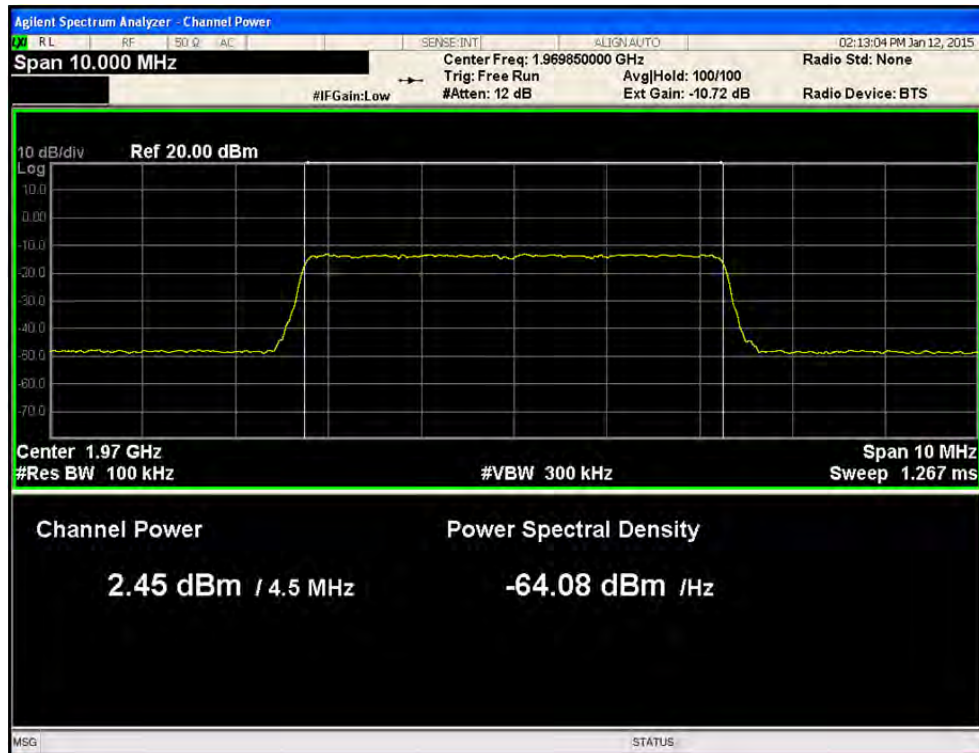
- Band 25/ Downlink / CDMA



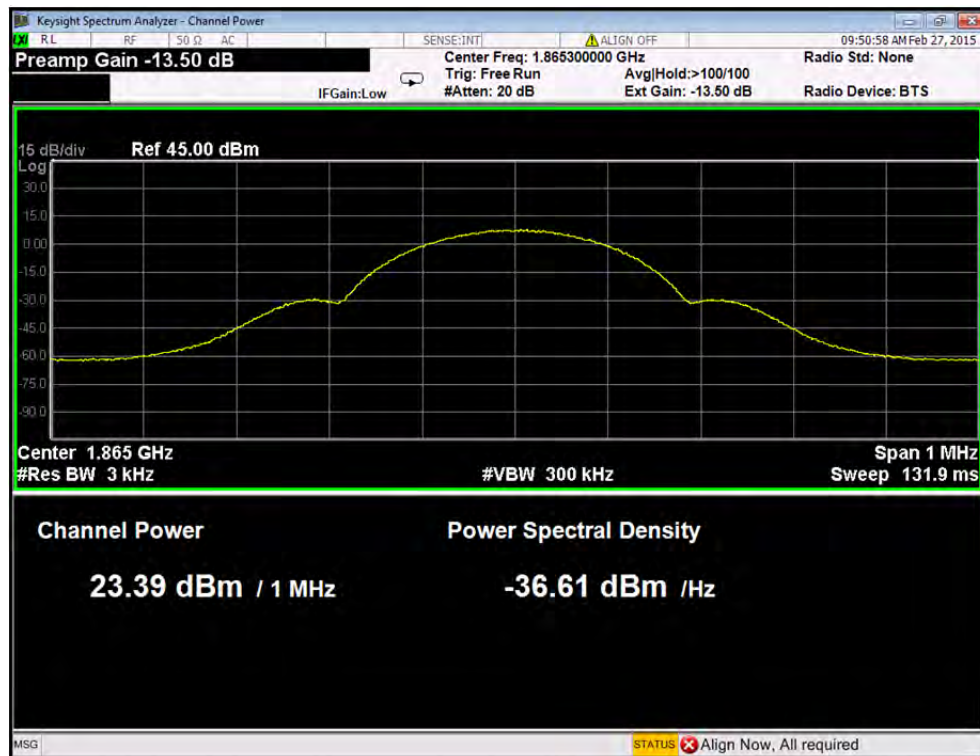
• Band 25/ Down link / AWGN



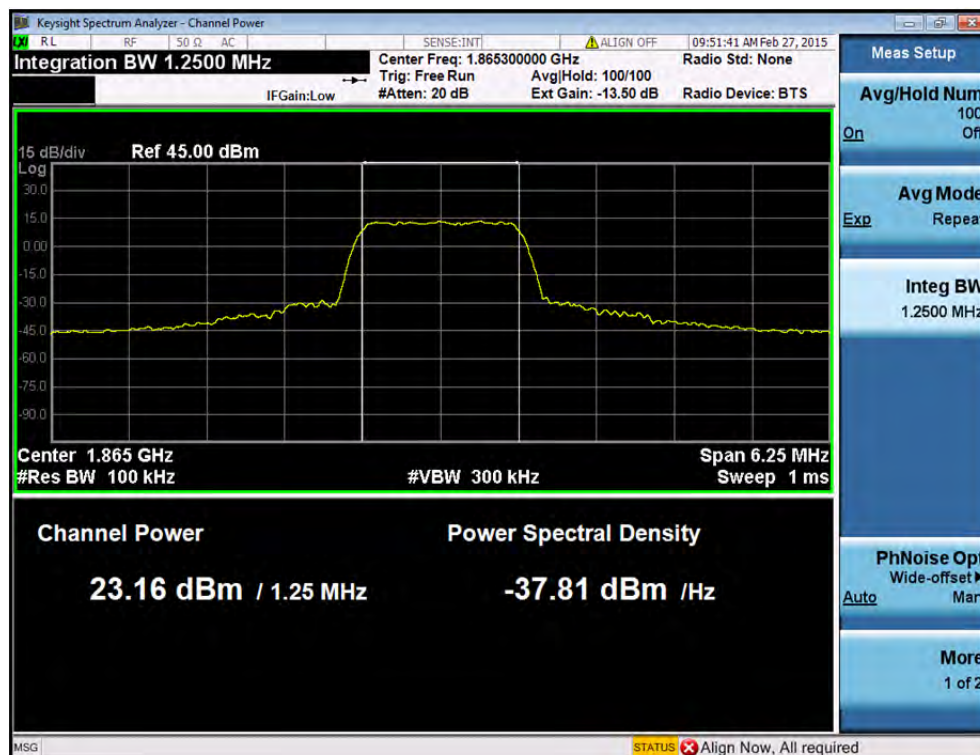
• Band 25/ Downlink / LTE



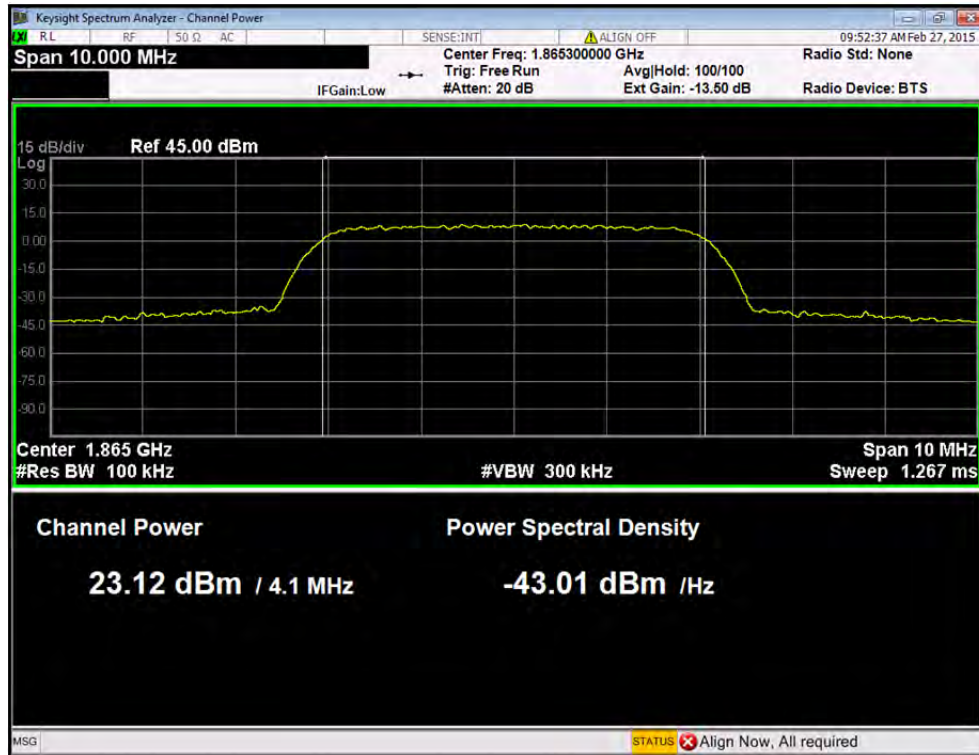
- Band 25/ Uplink / GSM



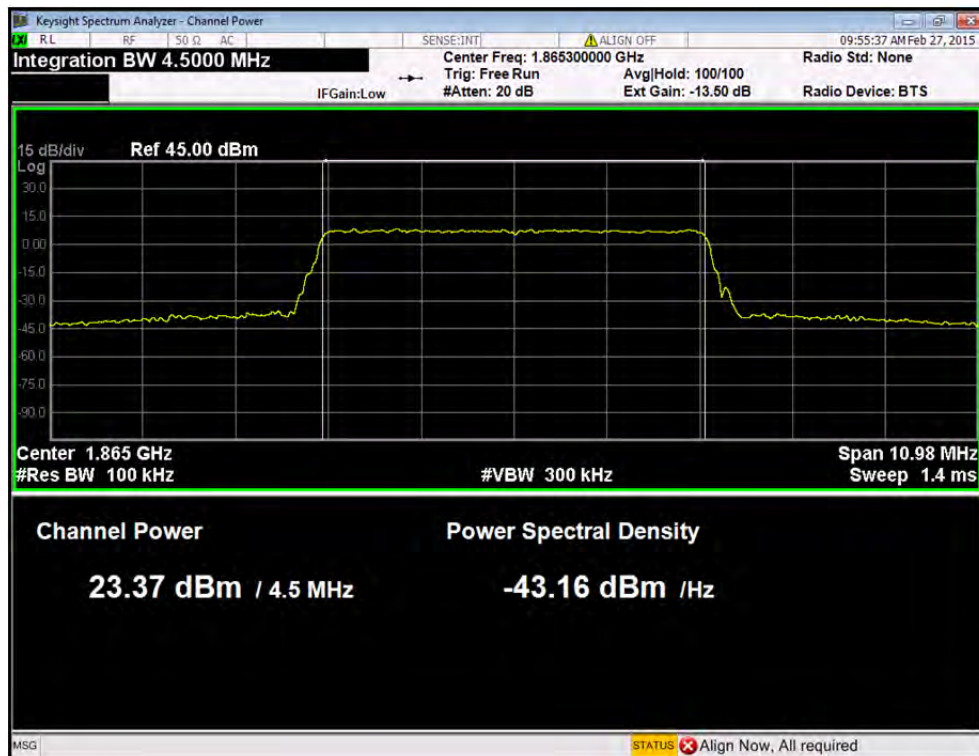
- Band 25/ Uplink / CDMA



- Band 25/ Uplink / AWGN



- Band 25/ Uplink / LTE



3.3 Maximum booster gain computation

3.3.1 Specification

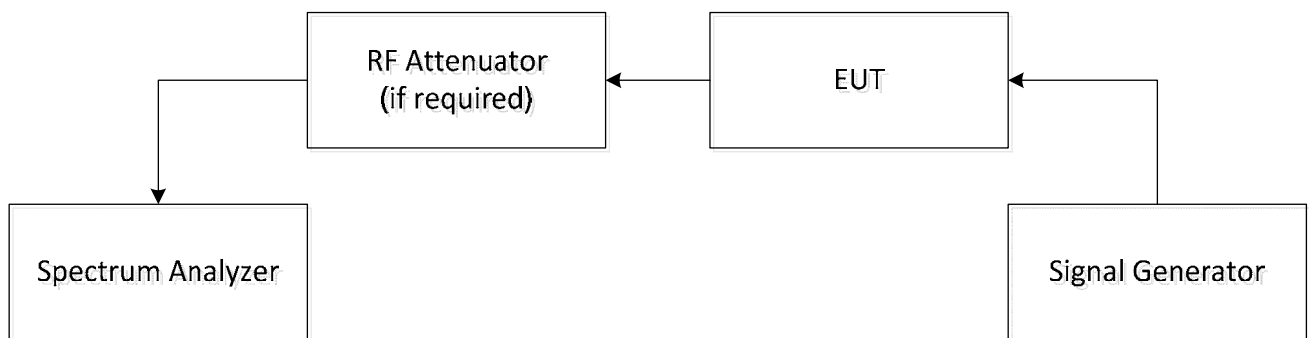
- FCC Part 20.21 (e)(8)(i)(B)
- FCC Part 20.21 (e)(8)(i)(C)(2)

3.3.2 Measurement method

- 935210 D03 Signal Booster Measurement v02r01
- Compute the maximum gain of the booster as follows to demonstrate compliance to the applicable gain limits as specified.
 - For both the uplink and downlink in each supported frequency band, use each of the P_{out} and P_{in} value pairs for all signal types used in 7.2 in the following equation to determine the maximum gain (G) of the booster:

$$G \text{ (dB)} = P_{out} \text{ (dBm)} - P_{in} \text{ (dBm)}$$
 - 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.

3.3.3 Set-Up



3.3.4 Limit

- Maximum gain limit = $6.5 \text{ dB} + 20 \log (F \text{ in MHz})$
- The uplink and downlink gain under each condition was verified to be within 9dB of each other.

3.3.5 Test equipment list

Equipment	Model Name	Manufacturer
EUT	USHR-781921-5B	OPISYS Incorporated
Signal Generator	N5182A	Agilent
Signal Generator	E4432B	Agilent
Spectrum Analyzer	N9020A	Agilent
Attenuator	AF115A-09-34	Weinschel

3.3.6 Test condition

- Test place: Shield Room
- Test environment: 23.0 °C, 44 % R.H.

3.3.7 Test results

Band	Link	Frequency [MHz]	Signal Type	Input Level [dBm]	Output Level [dBm]	Gain [dB]	Gain Limit [dB]	Margin [dB]
Band 12	Down Link	735.848	GSM	-58.0	2.86	60.86	63.83	2.97
			CDMA	-58.0	2.66	60.66		
			AWGN	-58.0	2.29	60.29		
			LTE	-58.0	2.25	60.25		
	Up Link	700.700	GSM	-37.0	23.84	60.84	63.41	2.45
			CDMA	-37.0	23.72	60.72		
			AWGN	-37.0	23.96	60.96		
			LTE	-37.0	23.53	60.53		
Band 13	Down Link	749.556	GSM	-58.0	2.01	60.01	63.99	3.94
			CDMA	-58.0	2.05	60.05		
			AWGN	-58.0	2.00	60.00		
			LTE	-58.0	2.02	60.02		
	Up Link	777.300	GSM	-38.0	23.43	61.43	64.31	2.88
			CDMA	-38.0	23.32	61.32		
			AWGN	-38.0	23.37	61.37		
			LTE	-38.0	23.22	61.22		

Band	Link	Frequency [MHz]	Signal Type	Input Level [dBm]	Output Level [dBm]	Gain [dB]	Gain Limit [dB]	Margin [dB]
Band 5	Down Link	875.900	GSM	-60.0	2.41	62.41	65.34	2.75
			CDMA	-60.0	2.58	62.58		
			AWGN	-60.0	2.59	62.59		
			LTE	-60.0	2.21	62.21		
	Up Link	834.680	GSM	-38.0	23.05	61.05	64.93	3.68
			CDMA	-38.0	23.12	61.12		
			AWGN	-38.0	23.03	61.03		
			LTE	-38.0	23.25	61.25		
Band 4	Down Link	2121.70	GSM	-68.0	2.38	70.38	73.03	2.59
			CDMA	-68.0	2.25	70.25		
			AWGN	-68.0	2.33	70.33		
			LTE	-68.0	2.44	70.44		
	Up Link	1714.5	GSM	-45.0	23.97	68.97	71.18	2.21
			CDMA	-45.0	23.81	68.81		
			AWGN	-45.0	23.83	68.83		
			LTE	-45.0	23.85	68.85		
Band 25	Down Link	1969.85	GSM	-67.0	2.41	69.41	72.38	2.93
			CDMA	-67.0	2.26	69.26		
			AWGN	-67.0	2.25	69.25		
			LTE	-67.0	2.45	69.45		
	Up Link	1865.30	GSM	-45.0	23.81	68.81	71.91	3.10
			CDMA	-45.0	23.70	68.70		
			AWGN	-45.0	23.72	68.72		
			LTE	-45.0	23.78	68.78		

3.4 Intermodulation product

3.4.1 Specification

- FCC Part 20.21 (e)(8)(i)(F)

3.4.2 Measurement method

- 935210 D03 Signal Booster Measurement v02r01
 - a) Connect the signal booster to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer.
 - b) Set the spectrum analyzer RBW = 3 kHz.
 - c) Set the VBW $\geq 3 \times$ the 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.
 - 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.
 - h) Set the signal generator amplitudes so that the power from each into the RF combiner is equivalent and turn on the RF output.
 - i) Increase the signal generators' amplitudes equally until just before the EUT begins AGC and ensure that all intermodulation products (if any exist), are below the specified limit of -19 dBm.
 - j) Utilize the trace averaging function of the spectrum analyzer and wait for the trace to stabilize. Place a marker at the highest amplitude intermodulation product.
 - 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 steps e) to l) for all uplink and downlink operational bands.

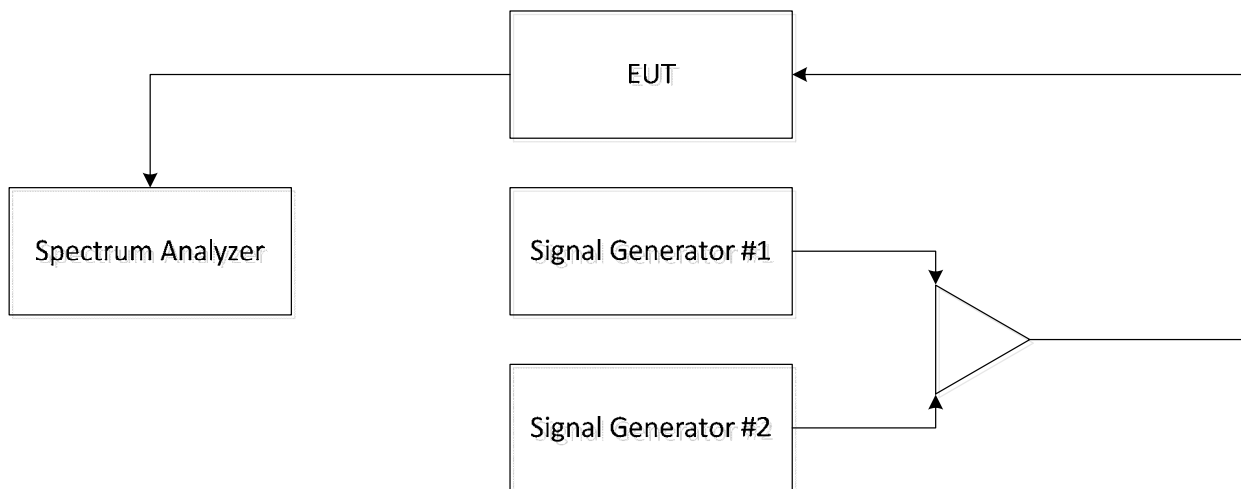
Note: If using a single signal generator with dual outputs, ensure that intermodulation products are not the result of the generator.

 - n) Increase the signal generator amplitude in 2 dB steps to 10 dB above the AGC threshold determined in i) to ensure that the EUT maintains compliance with the intermodulation

3.4.3 Limit

- The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of -19 dBm with a 3 kHz measurement bandwidth for the supported bands of operation

3.4.4 Set-Up



3.4.5 Test equipment list

Equipment	Model Name	Manufacturer
EUT	USHR-781921-5B	OPISYS Incorporated
Signal Generator	N5182A	Agilent
Signal Generator	E4432B	Agilent
RF Combiner	1506A	Weinschel
Spectrum Analyzer	N9020A	Agilent
Attenuator	AF115A-09-34	Weinschel

3.4.6 Test condition

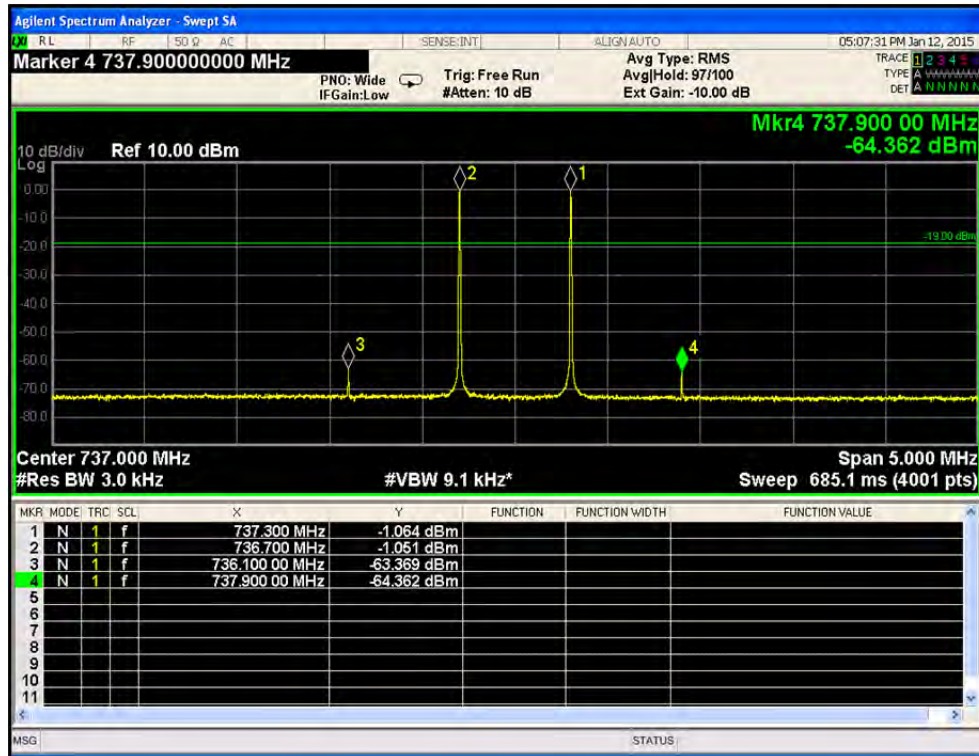
- Test place: Shield Room
- Test environment: 23.0 °C, 44 % R.H.

3.4.7 Test results

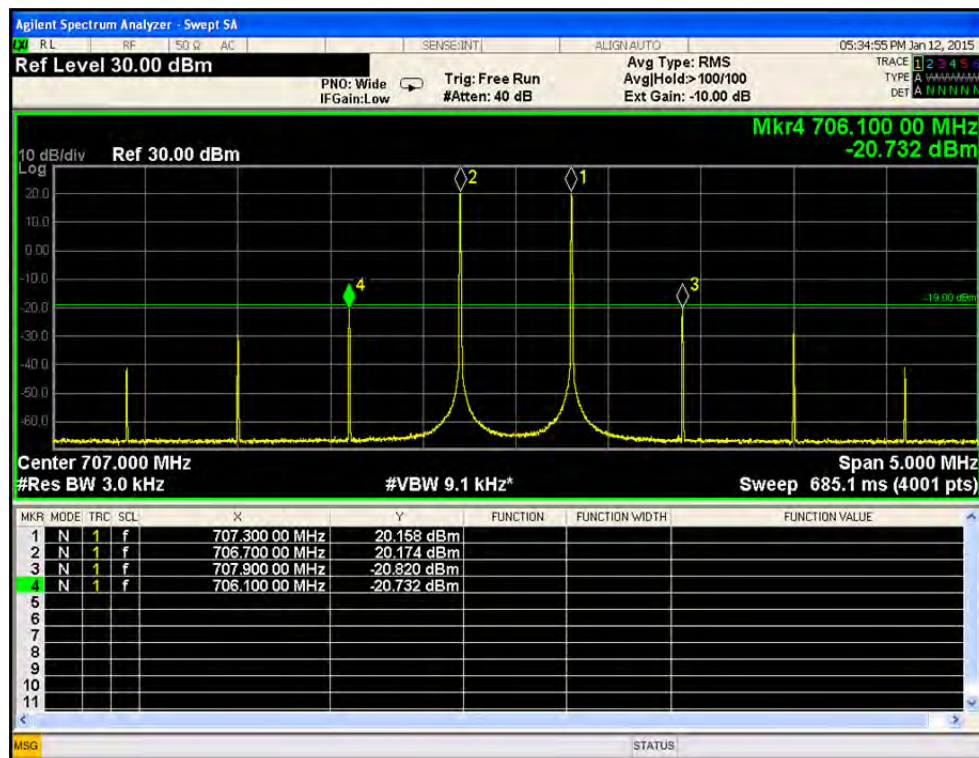
Band	Link	Frequency 1 [MHz]	Frequency 2 [MHz]	IMD Level [dBm]	IMD Limit [dB]	Margin [dB]
Band 12	Downlink	736.7	737.3	-63.36	-19.0	44.36
	Uplink	706.7	707.3	-20.73		1.73
Band 13	Downlink	751.2	751.8	-62.14		43.14
	Uplink	781.2	781.8	-23.87		4.87
Band 5	Downlink	881.2	881.8	-62.78		43.78
	Uplink	836.2	836.8	-26.06		7.06
Band 4	Downlink	2132.2	2132.8	Not found		N/A
	Uplink	1732.2	1732.8	-28.34		9.34
Band 25	Downlink	1962.2	1962.8	-58.73		39.73
	Uplink	1882.2	1882.8	-22.39		3.39

3.4.8 Test Plots

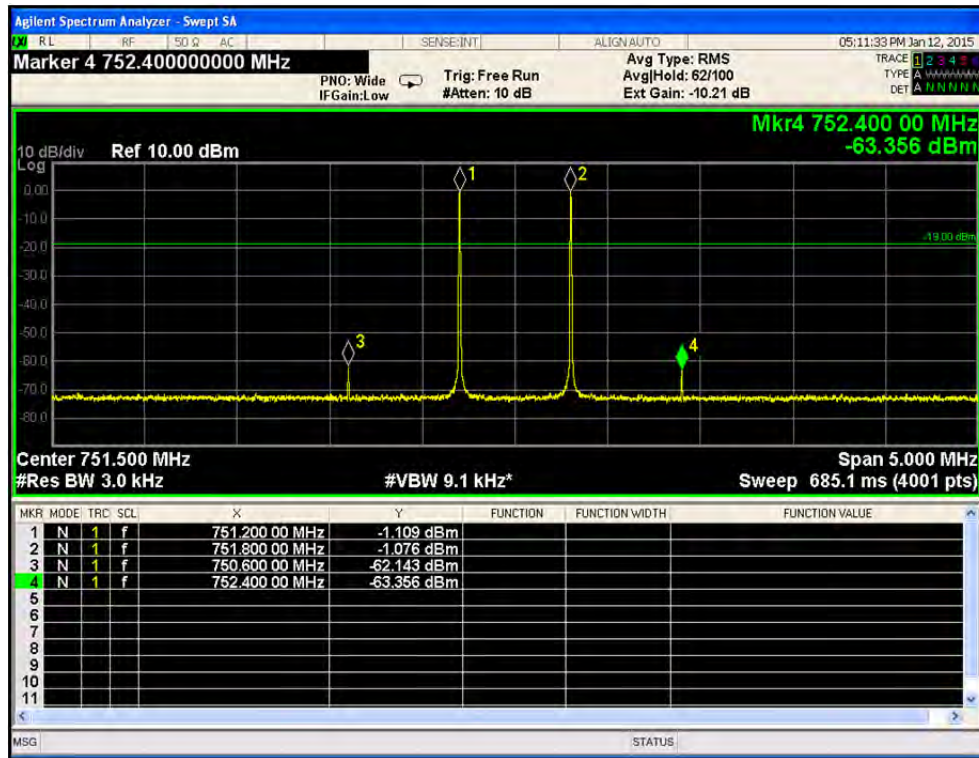
- Band 12 / Downlink



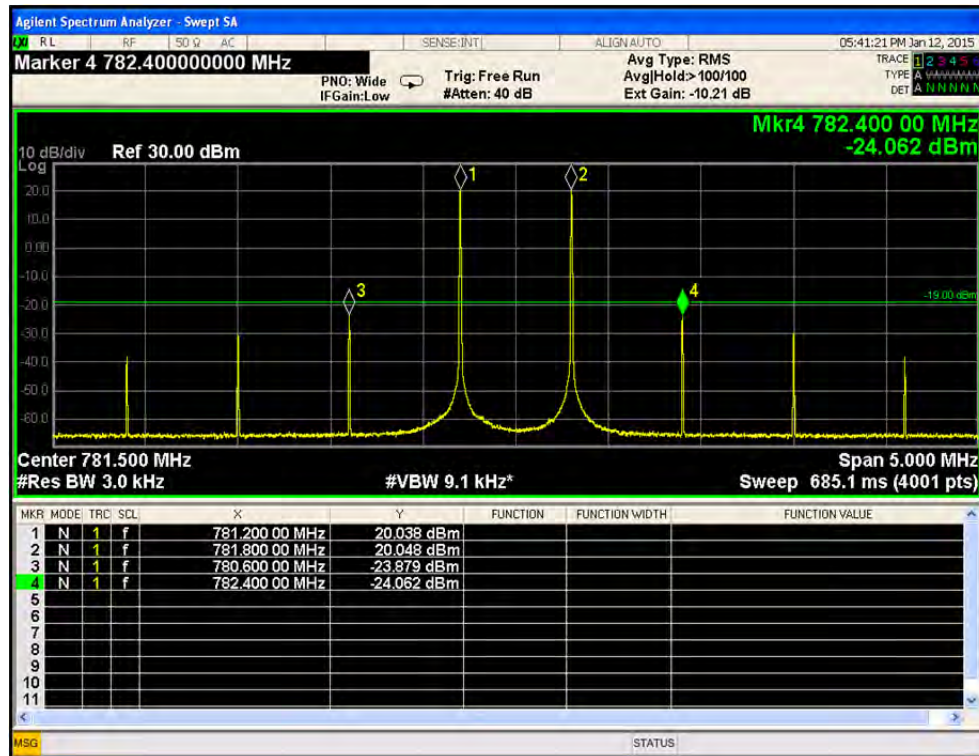
- Band 12 / Uplink



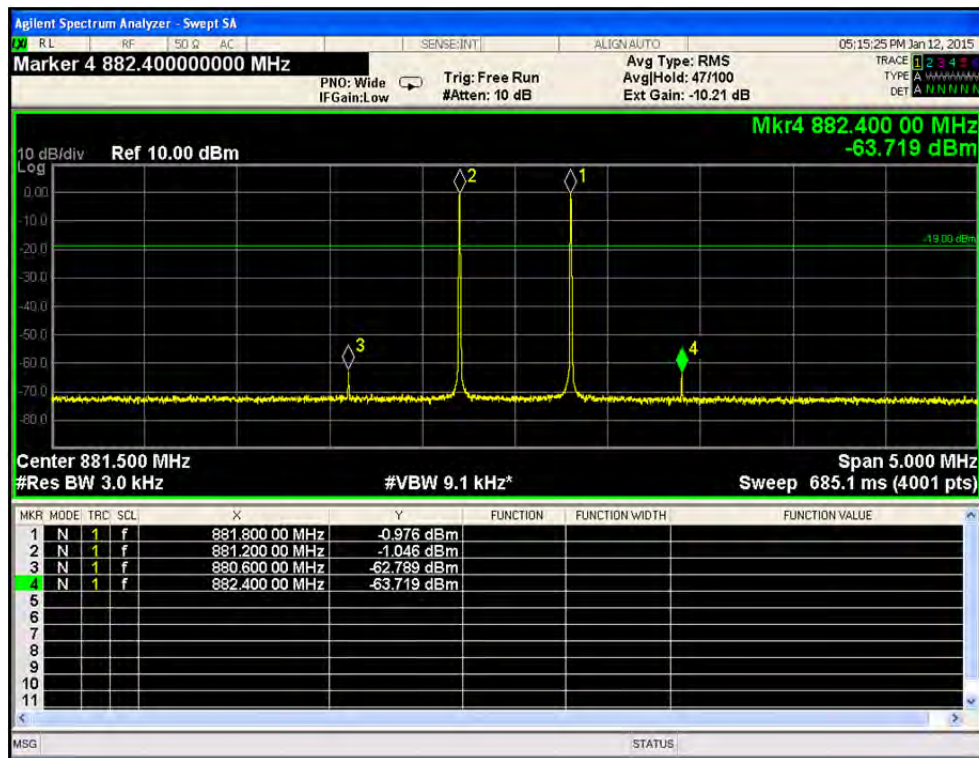
• Band 13 / Downlink



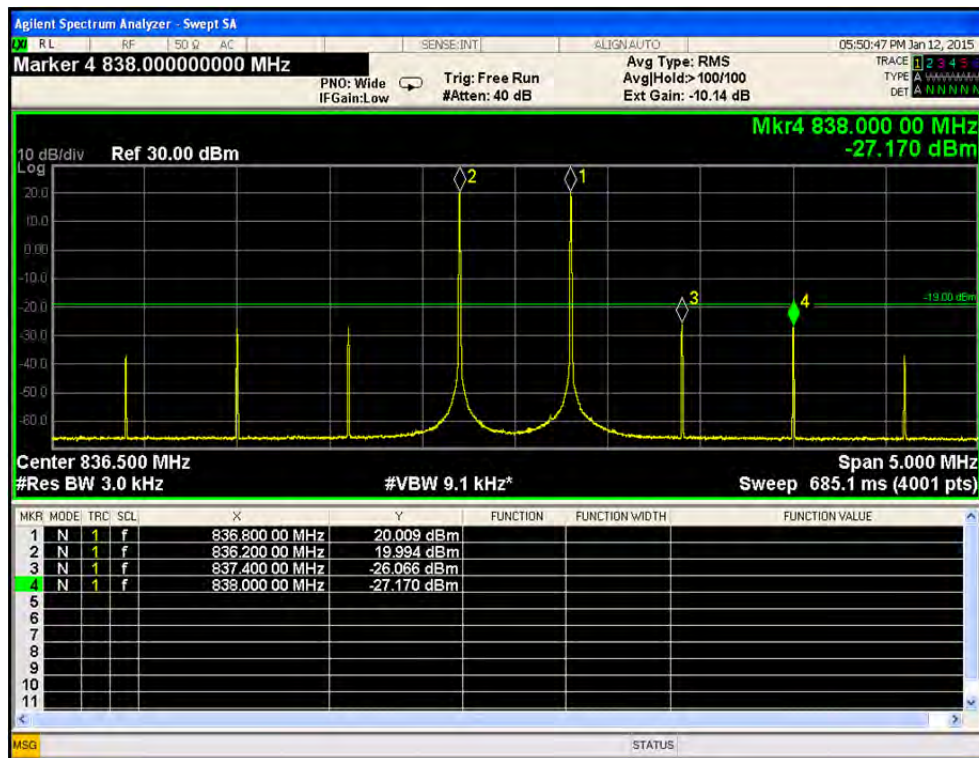
• Band 13 / Uplink



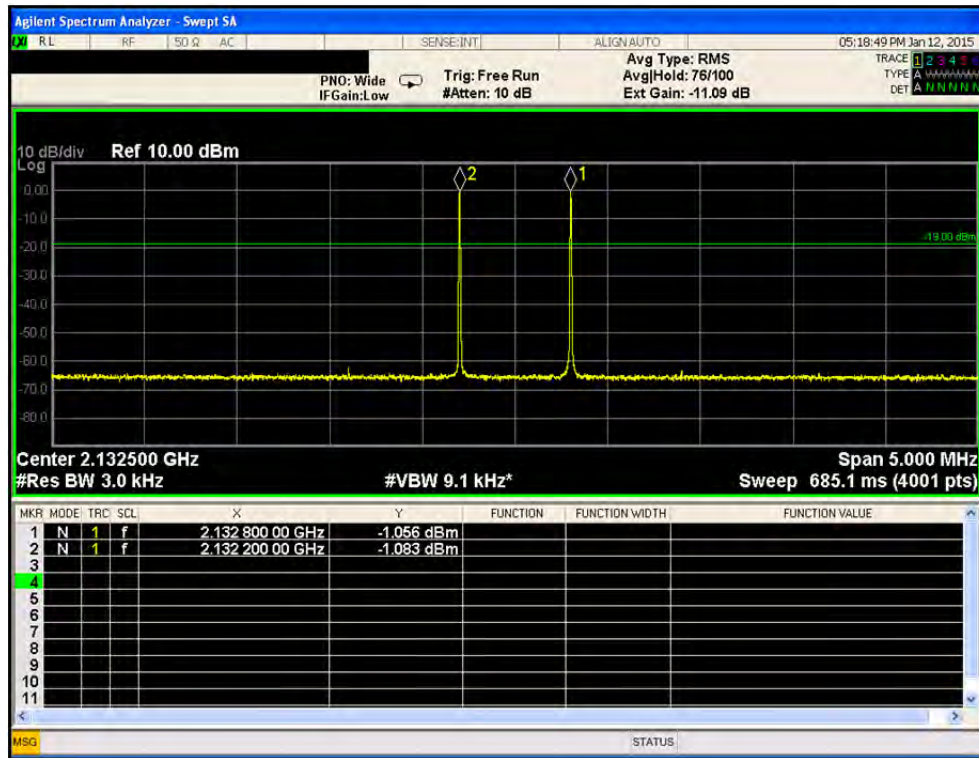
• Band 5 / Downlink



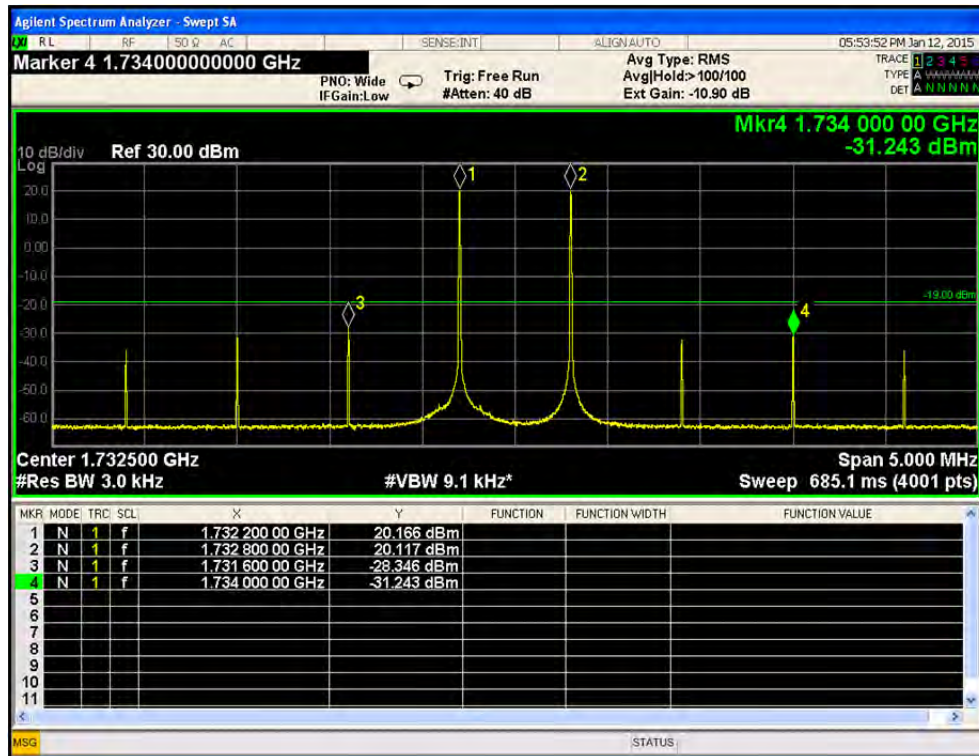
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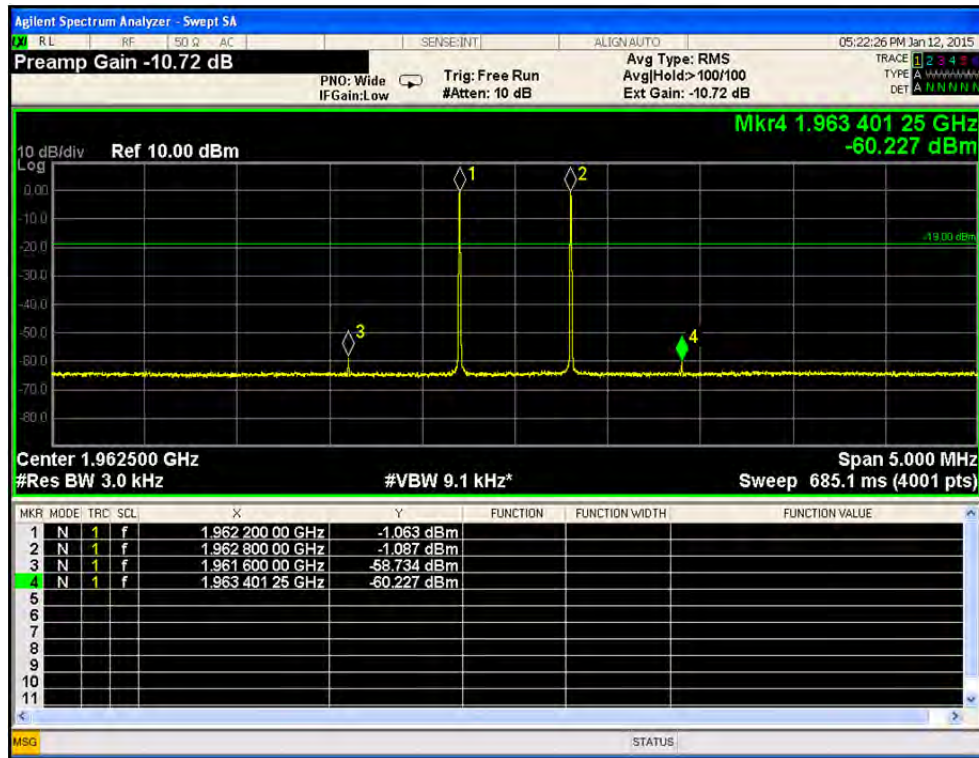
- Band 4 / Downlink



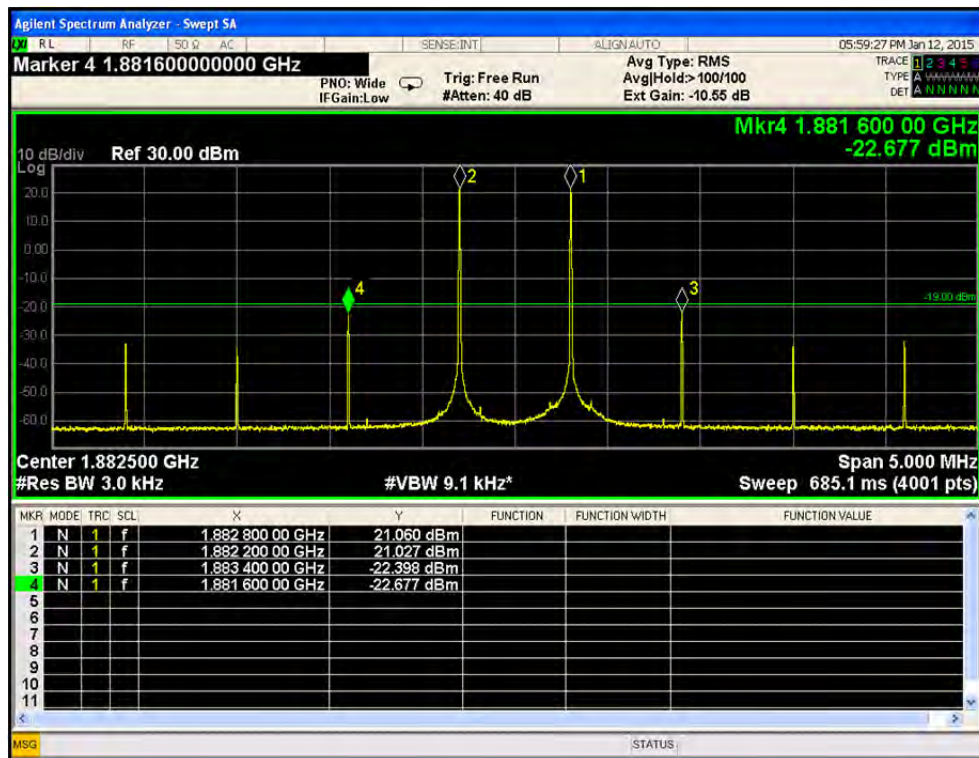
- Band 4 / Uplink



• Band 25/ Downlink



• Band 25/ Uplink



3.5 Out of band emission

3.5.1 Specification

- FCC Part 20.21 (e)(8)(i)(E)

3.5.2 Measurement method

- 935210 D03 Signal Booster Measurement v02r01

- a) Connect the EUT to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer.
- b) Configure the signal generator for the appropriate operation for all uplink and downlink bands:
 - i) GSM: 0.2 MHz from upper and lower band edge
 - ii) LTE (5 MHz): 2.5 MHz from upper and lower band edge
 - iii) CDMA: 1.25 MHz from upper and lower band edge, except for cellular 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 utilize 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.

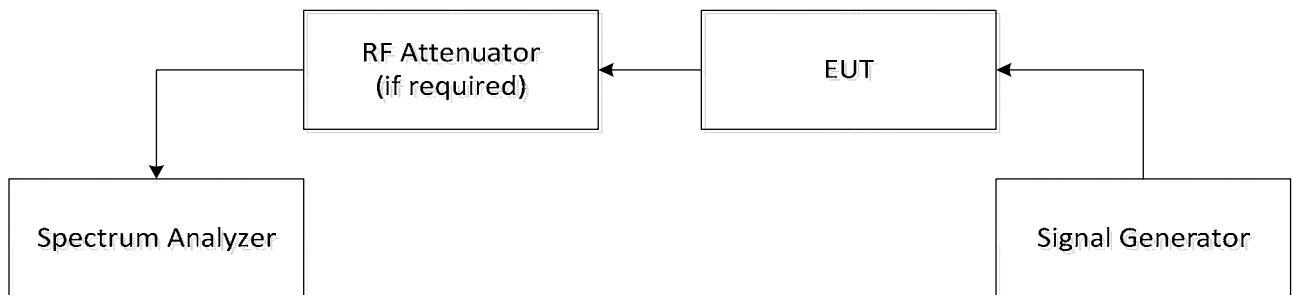
Note 3: AWGN is the measured 99% occupied bandwidth.

- c) Set the signal generator amplitude to the maximum power level prior to AGC similar to the procedures in method of Maximum power d) to f) of power measurement procedure for appropriate modulations.
- d) Set RBW = measurement bandwidth specified in the applicable rule section for the supported frequency band.
- e) Set VBW = 3 x RBW.
- f) Select the RMS (power averaging) 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 indicated in 5.4 is reached. Ensure that the EUT maintains compliance with the OOB limits.
- m) Reset the analyzer start frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as per applicable rule part, and the stop frequency to the lower band/block edge frequency and repeat steps j) to l).
- n) Repeat steps b) through m) for each uplink and downlink operational band.

3.5.3 Limit

- 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.
- Out of band emissions limit = $-6 + (P2 - (43 + 10 \log (P1))) = -19 \text{ dBm}$
- P1: Output Watt, P2: Output dBm

3.5.4 Set-Up



3.5.5 Test equipment list

Equipment	Model Name	Manufacturer
EUT	USHR-781921-5B	OPISYS Incorporated
Signal Generator	N5182A	Agilent
Signal Generator	E4432B	Agilent
Spectrum Analyzer	N9020A	Agilent
Attenuator	AF115A-09-34	Weinschel

3.5.6 Test condition

- Test place: Shield Room
- Test environment: 23.0 °C, 44 % R.H.

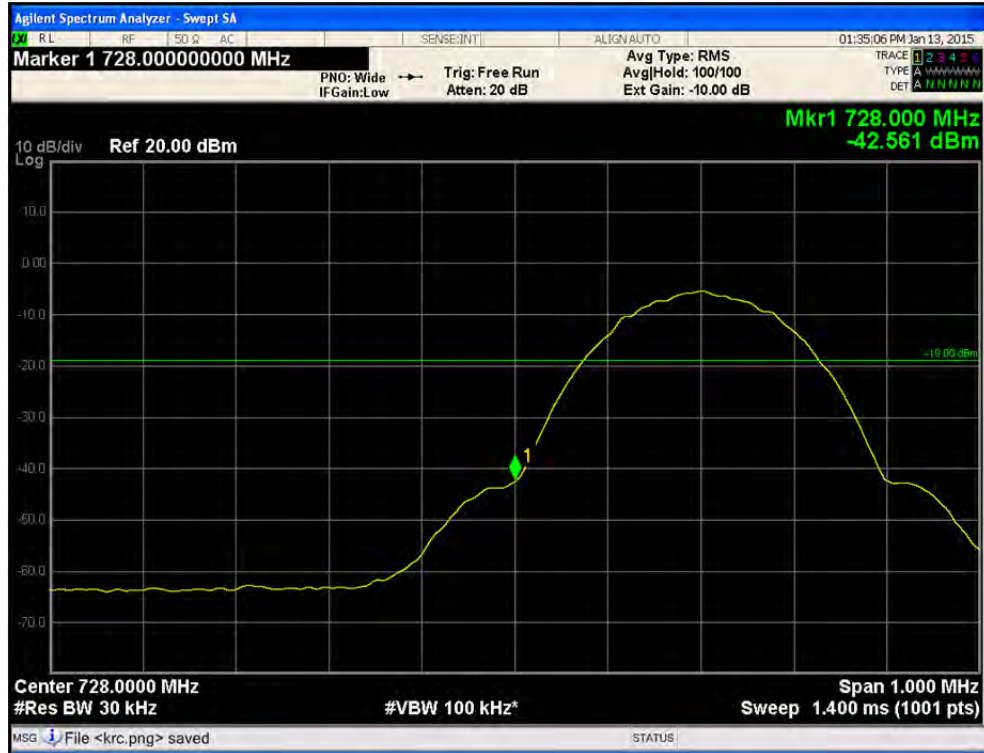
3.5.7 Test Results

Band	Link	Signal Type	Band Edge	Operation Frequency [MHz]	Emission Level [dBm]	Emission Limit [dB]	Result
Band 12	Down Link	GSM	Lower	728.20	-42.56	-19.0	Pass
			Upper	745.80	-42.28		
		CDMA	Lower	729.25	-62.89		
			Upper	744.75	-62.35		
		AWGN	Lower	730.50	-61.92		
			Upper	743.50	-61.39		
	Up Link	GSM	Lower	698.20	-21.51		
			Upper	715.80	-22.09		
		CDMA	Lower	699.25	-38.40		
			Upper	714.75	-42.24		
		AWGN	Lower	700.50	-38.87		
			Upper	713.50	-41.99		
Band 13	Down Link	GSM	Lower	746.20	-41.13		
			Upper	756.80	-44.50		
		CDMA	Lower	747.25	-62.42		
			Upper	755.75	-65.21		
		AWGN	Lower	748.50	-61.73		
			Upper	754.50	-63.36		
	Up Link	GSM	Lower	776.20	-20.59		
			Upper	786.80	-21.15		
		CDMA	Lower	777.25	-35.68		
			Upper	785.75	-35.76		
		AWGN	Lower	778.50	-38.32		
			Upper	784.50	-37.94		
Band 5	Down Link	GSM	Lower	869.20	-43.43		
			Upper	893.80	-42.07		
		CDMA	Lower	870.25	-63.31		
			Upper	892.75	-62.94		
		AWGN	Lower	871.50	-62.30		
			Upper	891.50	-62.18		

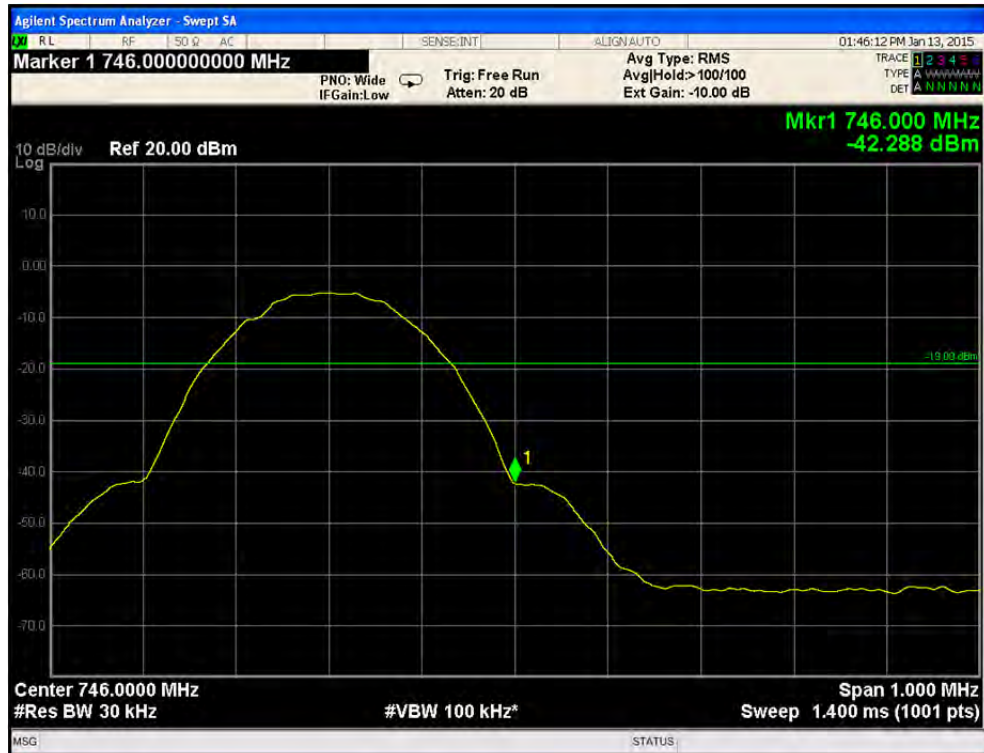
Band	Link	Signal Type	Band Edge	Operation Frequency [MHz]	Emission Level [dBm]	Emission Limit [dB]	Result
Band 5	Up Link	GSM	Lower	824.20	-20.22	-19.0	Pass
			Upper	849.20	-22.05		
		CDMA	Lower	825.25	-38.77		
			Upper	847.75	-42.47		
		AWGN	Lower	826.50	-40.72		
			Upper	846.50	-42.99		
Band 4	Down Link	GSM	Lower	2110.20	-40.70		
			Upper	2154.80	-42.02		
		CDMA	Lower	2111.25	-54.30		
			Upper	2153.75	-55.86		
		AWGN	Lower	2112.50	-54.43		
			Upper	2152.50	-56.16		
	Up Link	GSM	Lower	1710.20	-20.43		
			Upper	1755.20	-20.36		
		CDMA	Lower	1711.25	-38.75		
			Upper	1753.75	-39.91		
		AWGN	Lower	1712.50	-39.11		
			Upper	1752.50	-41.67		
Band 25	Down Link	GSM	Lower	1930.20	-42.73		
			Upper	1994.80	-43.15		
		CDMA	Lower	1931.25	-54.37		
			Upper	1993.75	-53.20		
		AWGN	Lower	1932.50	-54.62		
			Upper	1992.50	-52.80		
	Up Link	GSM	Lower	1850.20	-20.25		
			Upper	1915.20	-23.25		
		CDMA	Lower	1851.25	-31.63		
			Upper	1913.75	-36.44		
		AWGN	Lower	1852.50	-34.29		
			Upper	1912.50	-37.66		

3.5.8 Test Plots

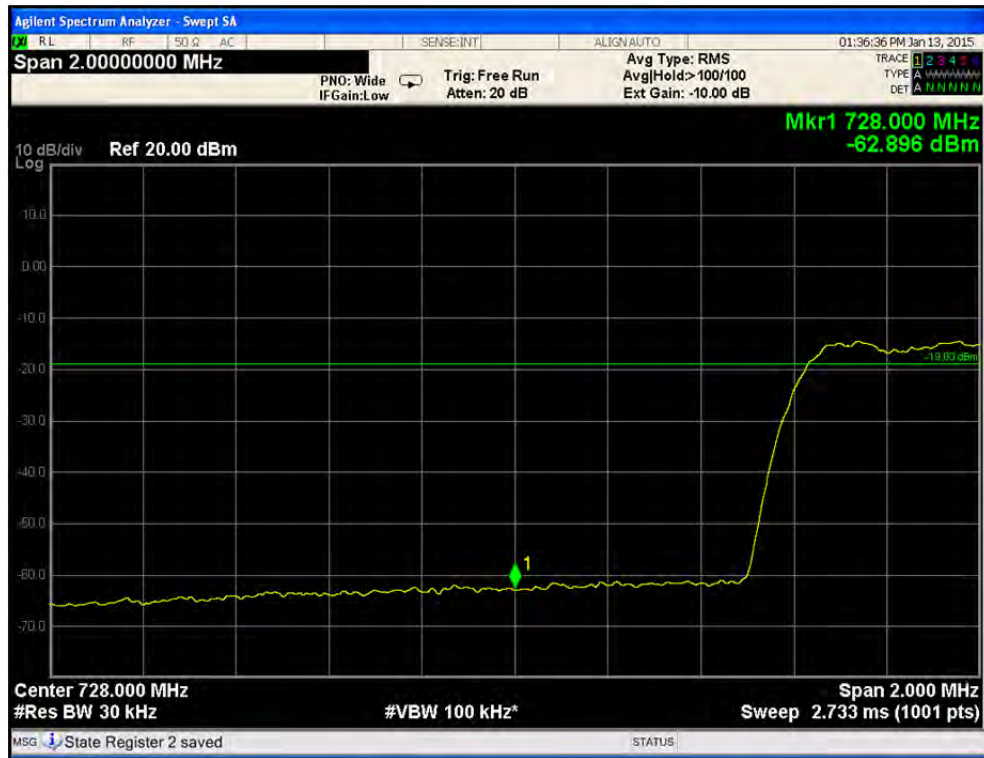
- Band 12 / Downlink / Lower side / GSM



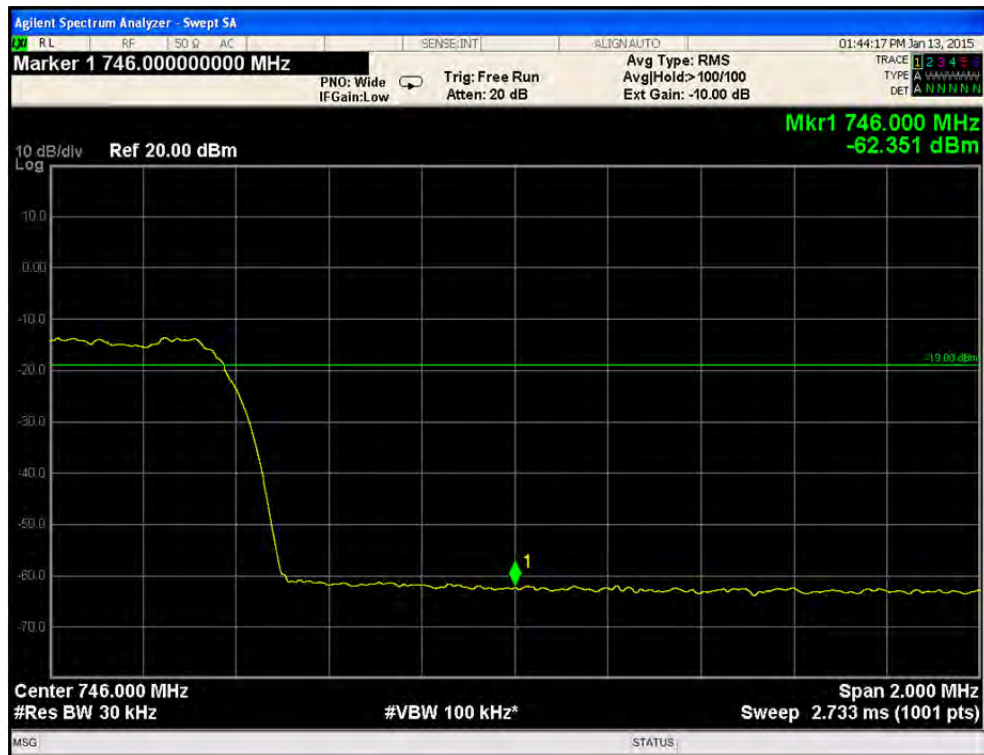
- Band 12 / Downlink / Upper side / GSM



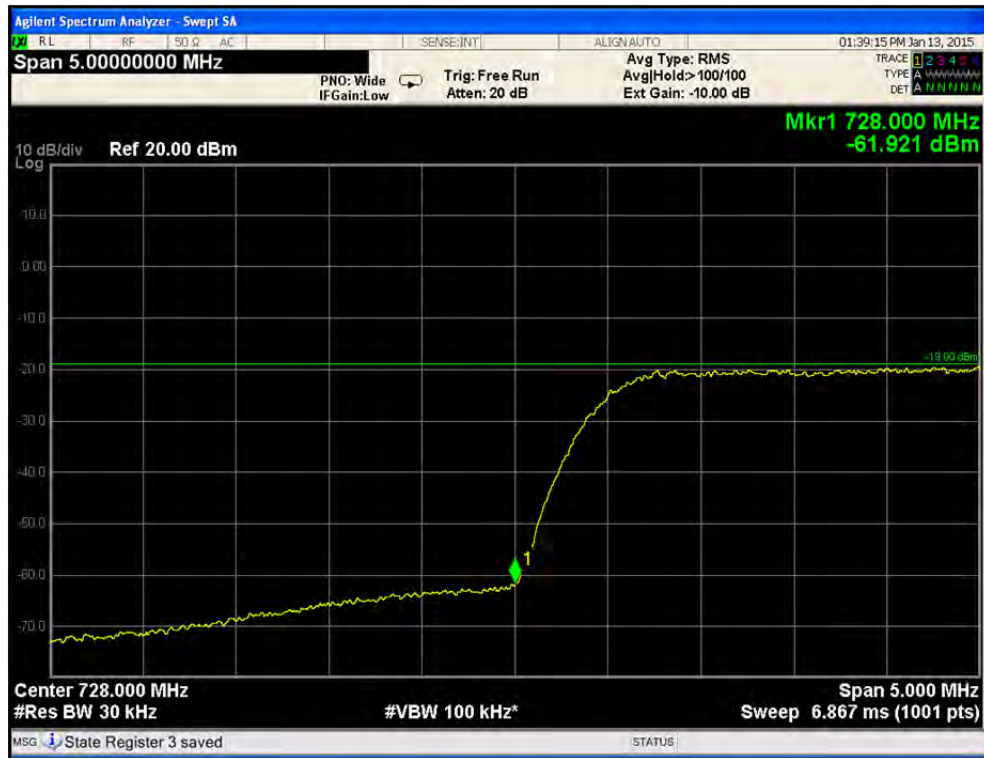
- Band 12 / Downlink / Lower side / CDMA



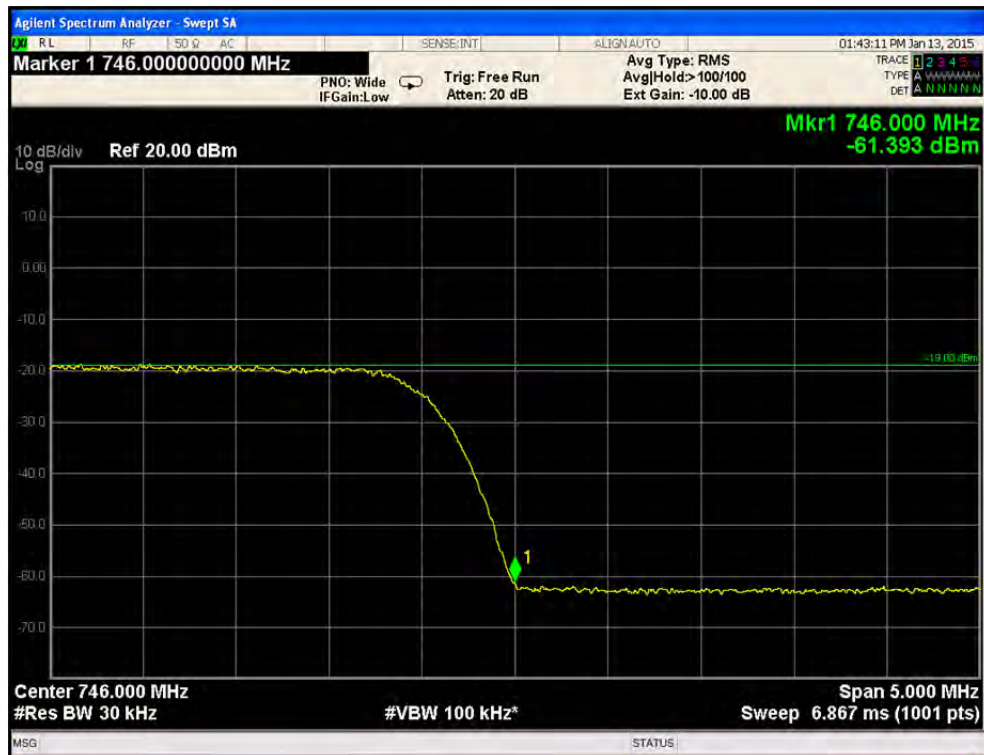
- Band 12 / Downlink / Upper side / CDMA



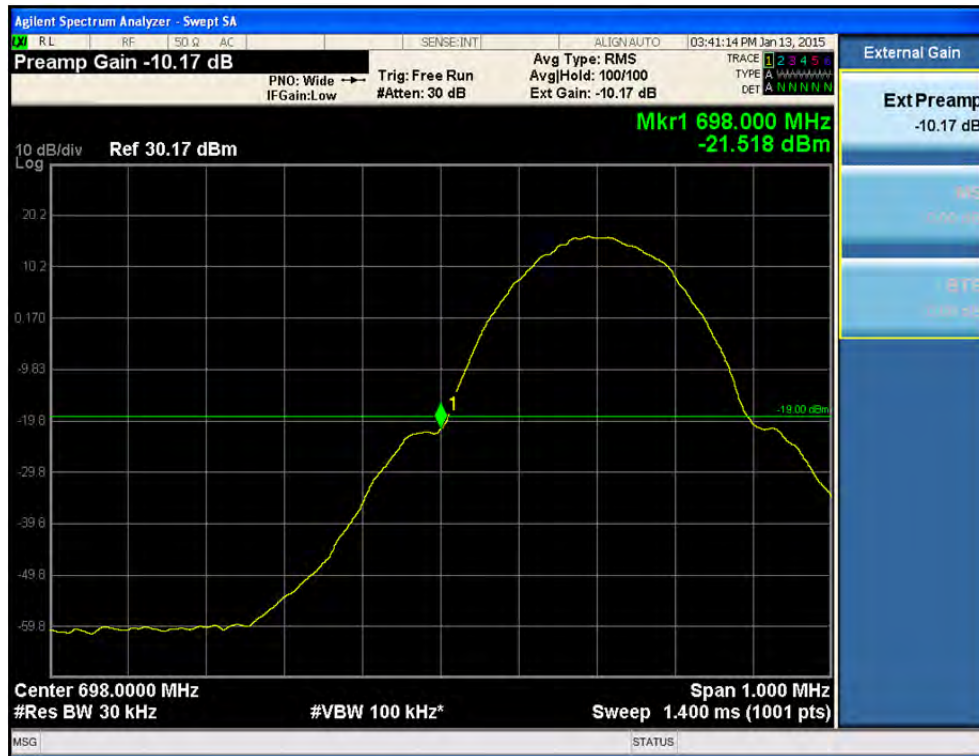
- Band 12 / Downlink / Lower side / AWGN



- Band 12 / Downlink / Upper side / AWGN



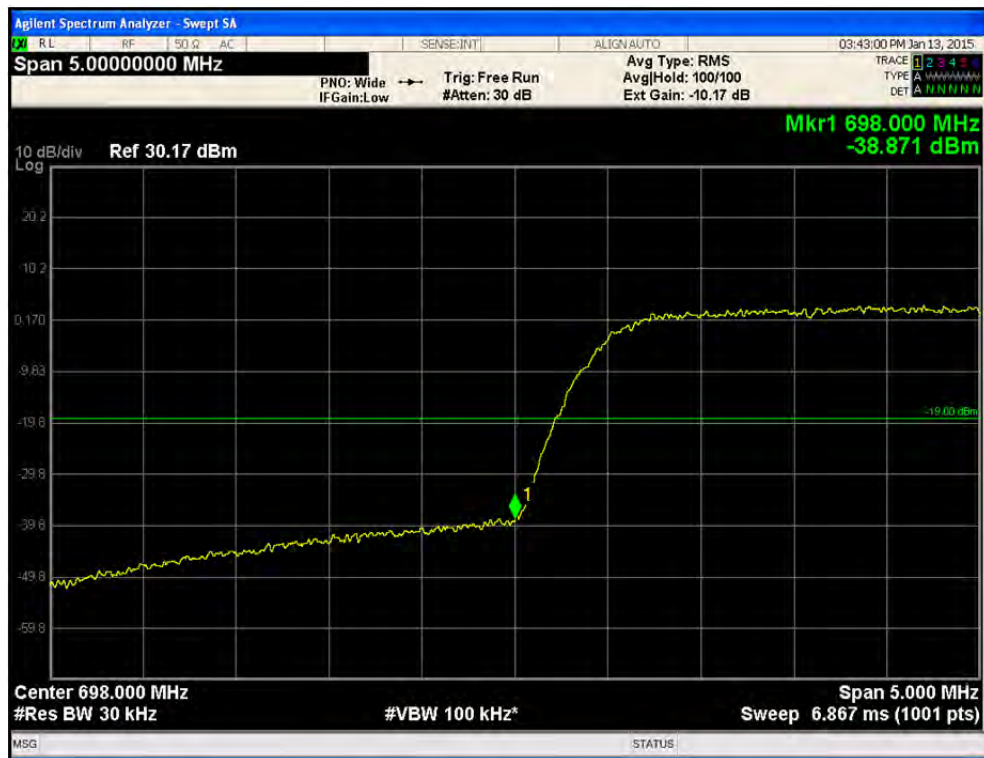
- Band 12 / Uplink / Lower side / GSM



- Band 12 / Uplink / Upper side / GSM

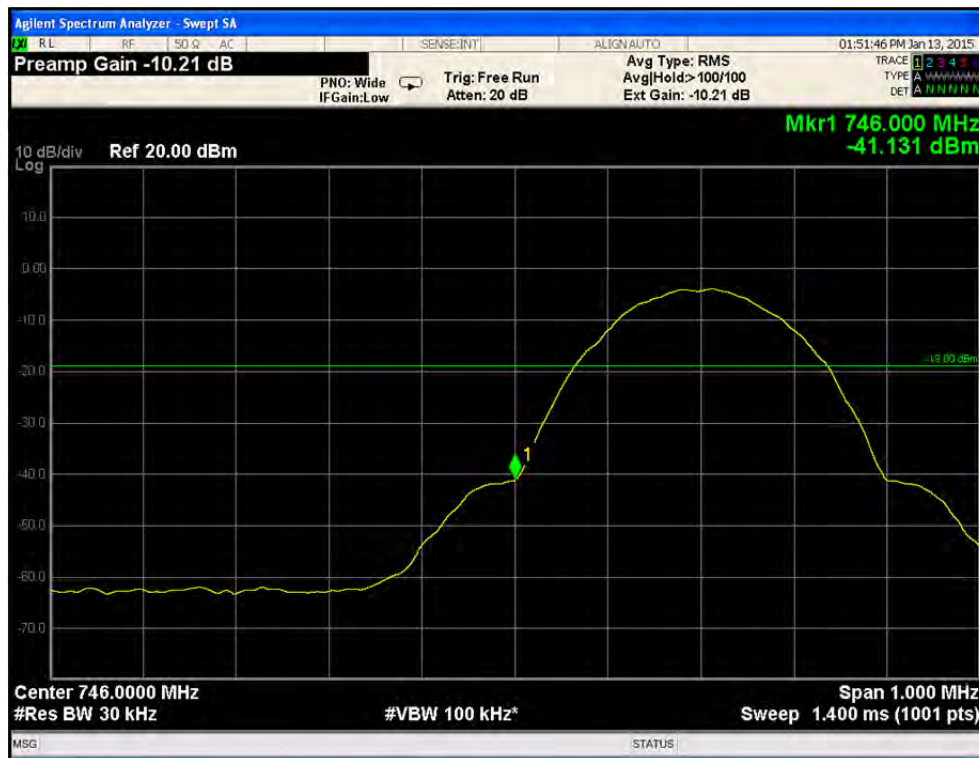


- Band 12 / Uplink / Lower side / AWGN

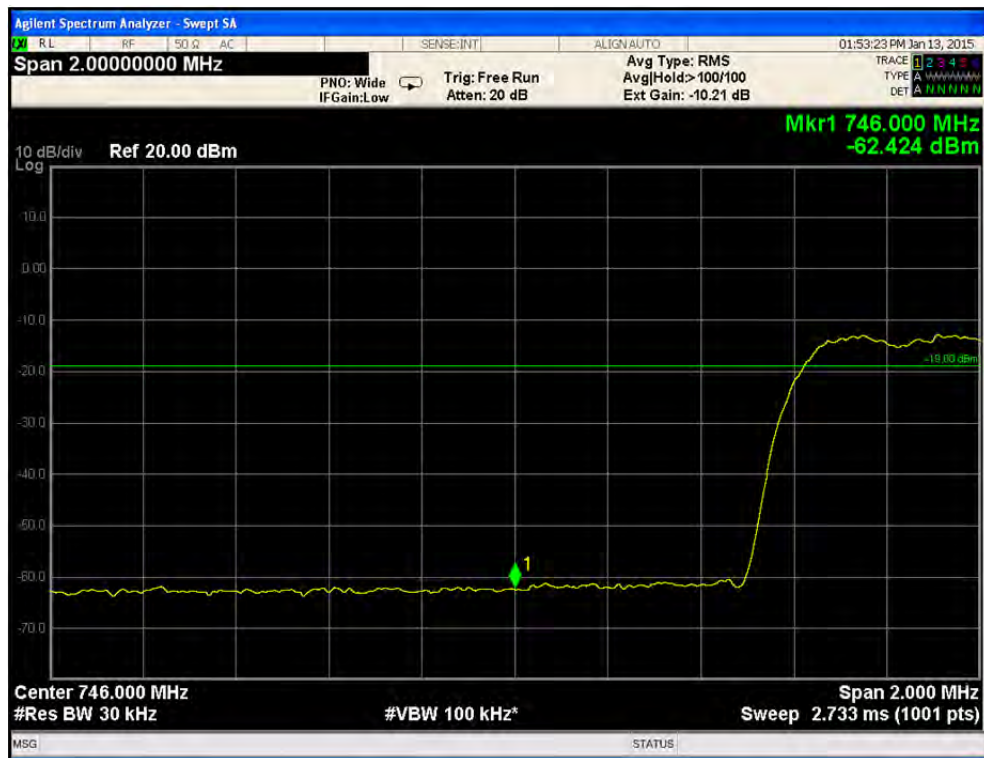


- Band 12 / Uplink / Upper side / AWGN

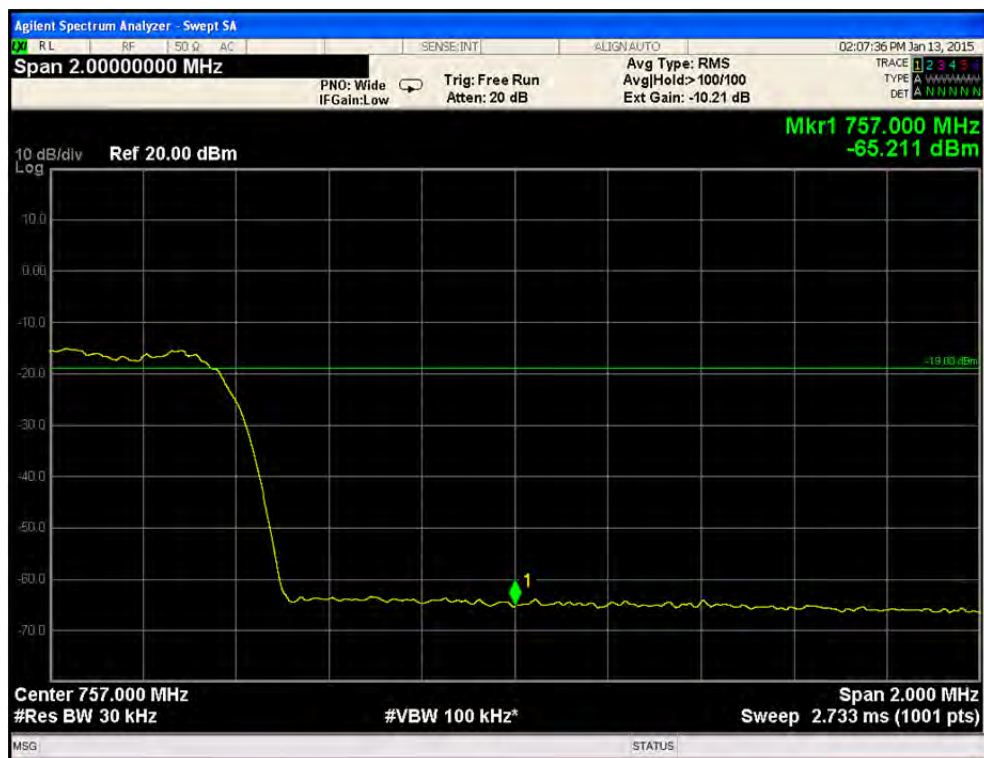




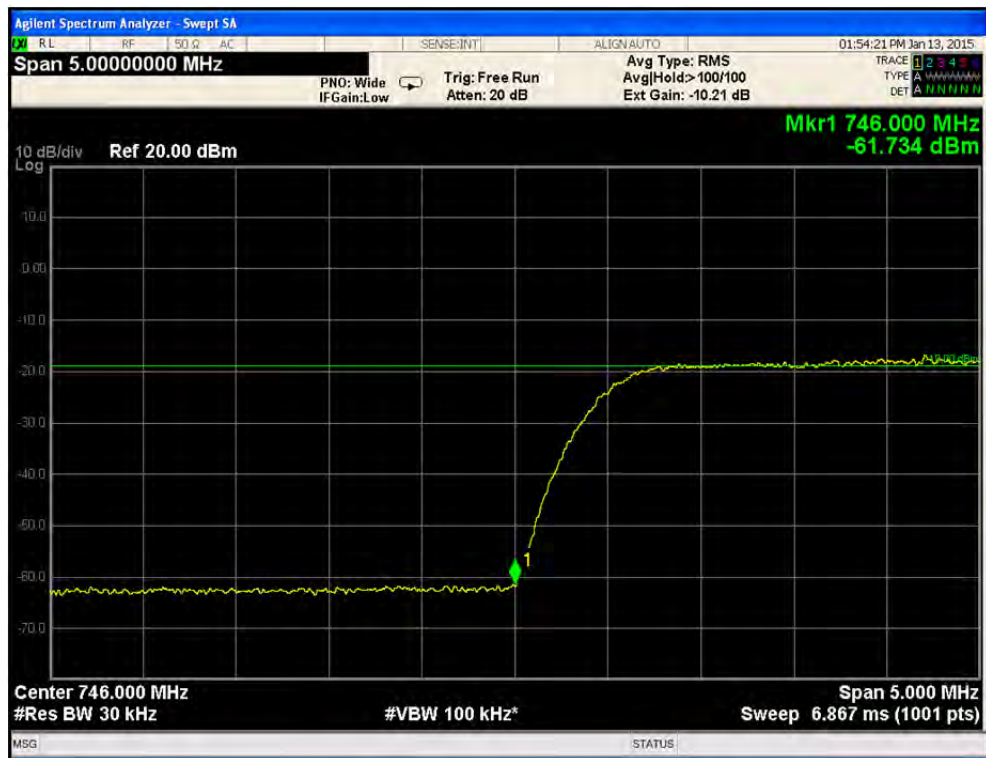
- Band 13 / Downlink / Lower side / CDMA



- Band 13 / Downlink / Upper side / CDMA



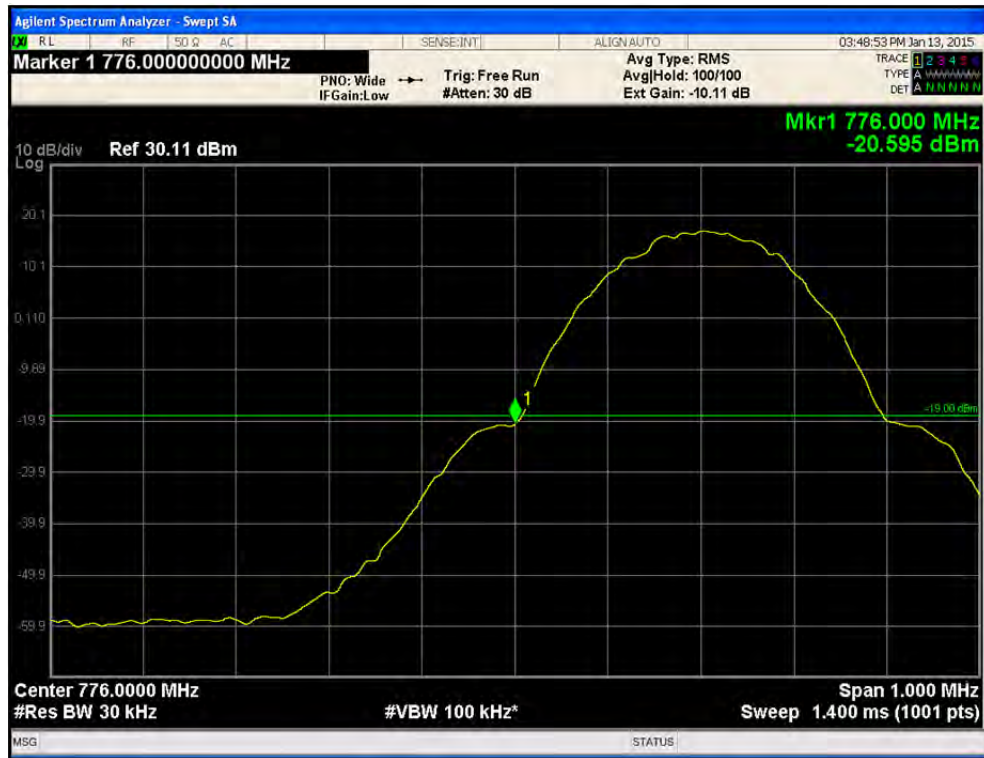
- Band 13 / Downlink / Lower side / AWGN



- Band 13 / Downlink / Upper side / AWGN



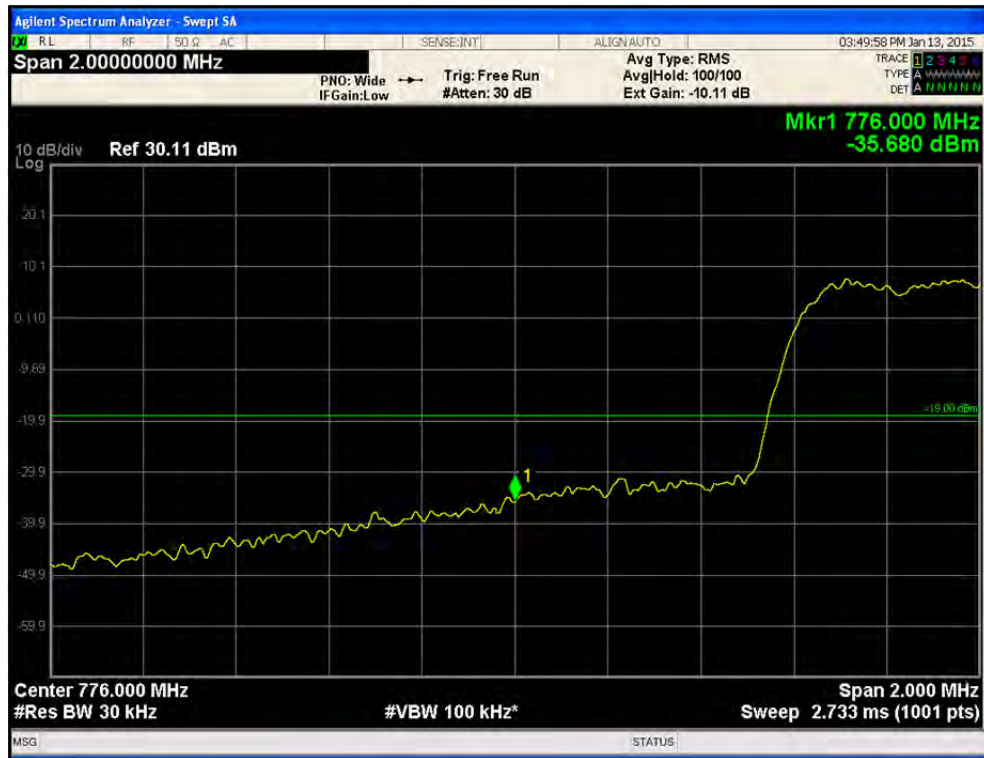
- Band 13 / Uplink / Lower side / GSM



- Band 13 / Uplink / Upper side / GSM



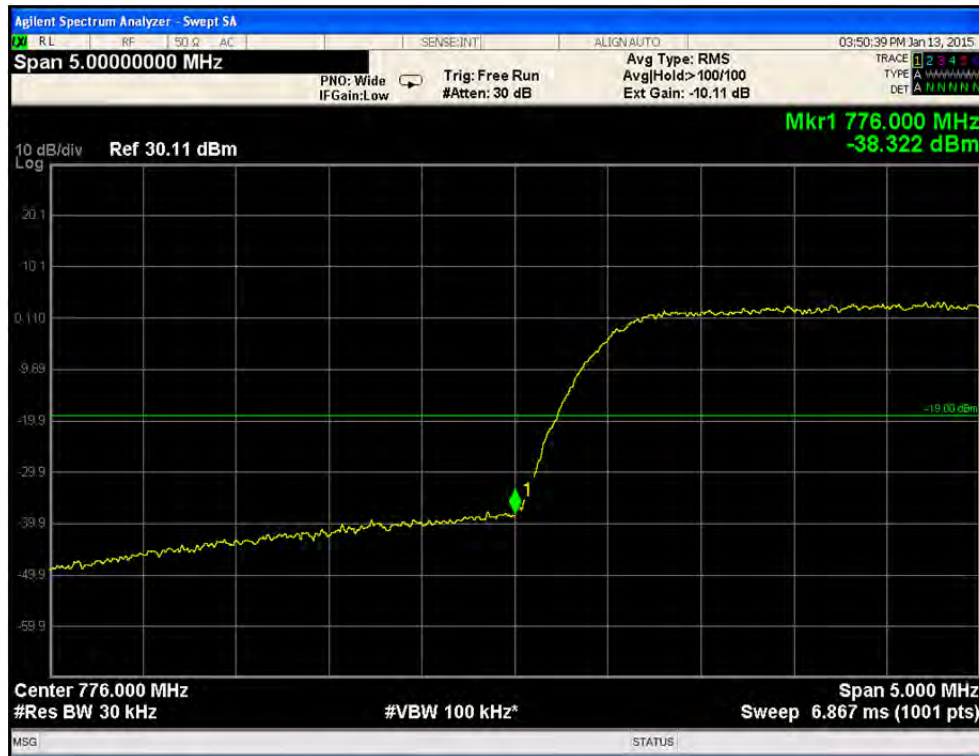
- Band 13 / Uplink / Lower side / CDMA



- Band 13 / Uplink / Upper side / CDMA



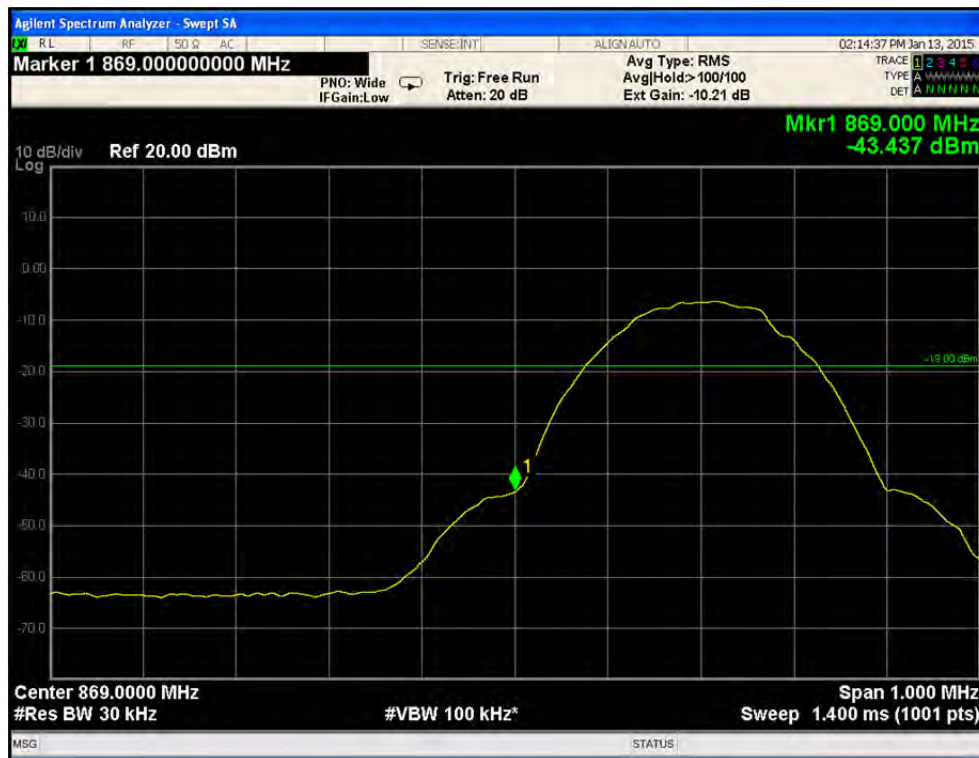
- Band 13 / Uplink / Lower side / AWGN



- Band 13 / Uplink / Upper side / AWGN



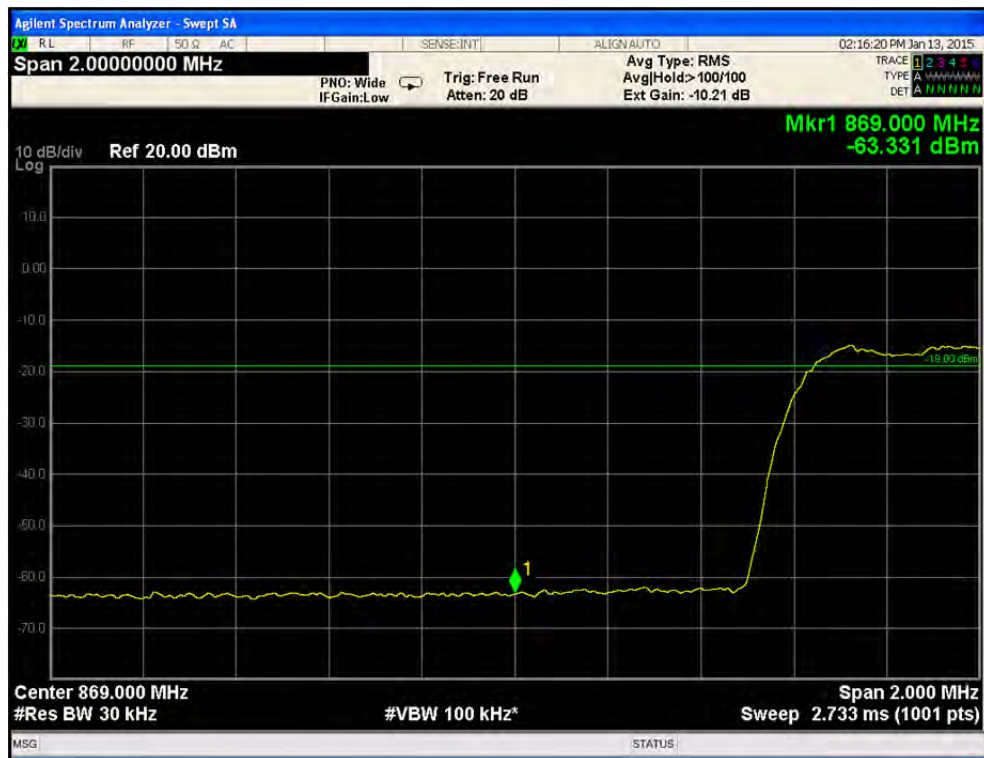
- Band 5 / Downlink / Lower side / GSM



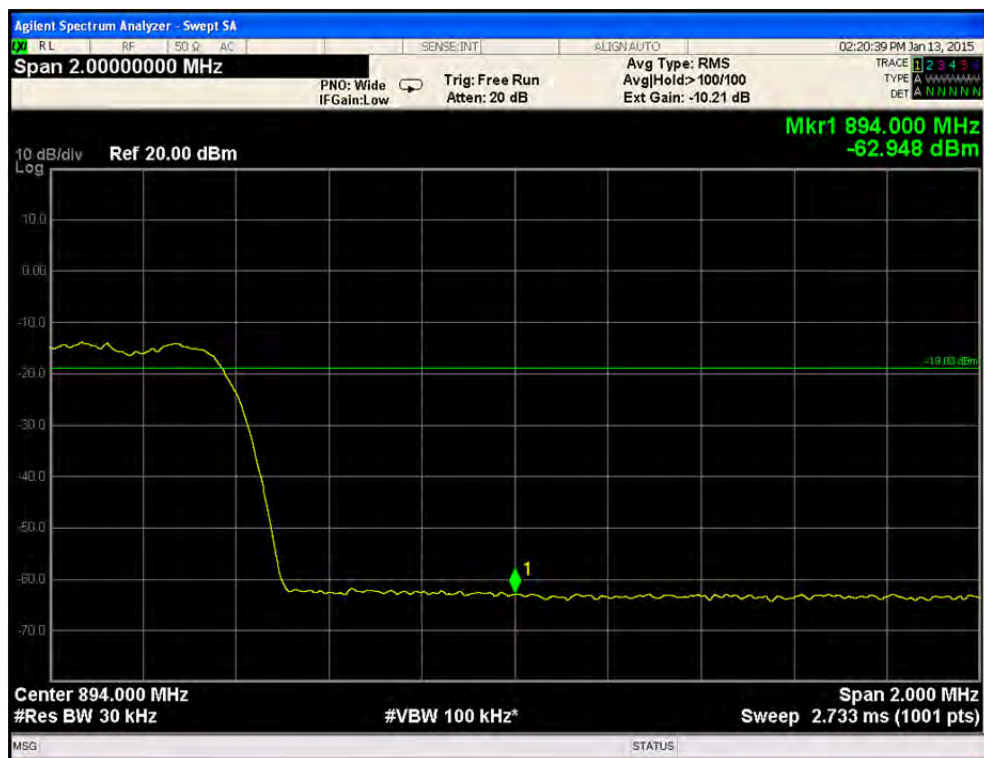
- Band 5 / Downlink / Upper side / GSM



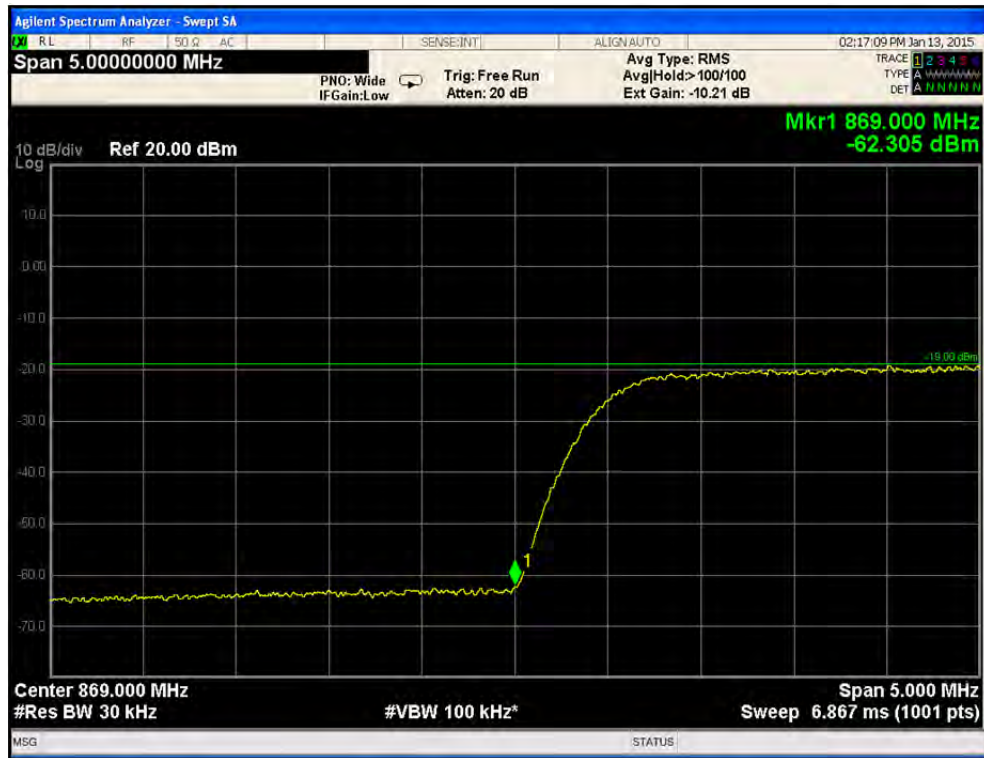
- Band 5 / Downlink / Lower side / CDMA



- Band 5 / Downlink / Upper side / CDMA



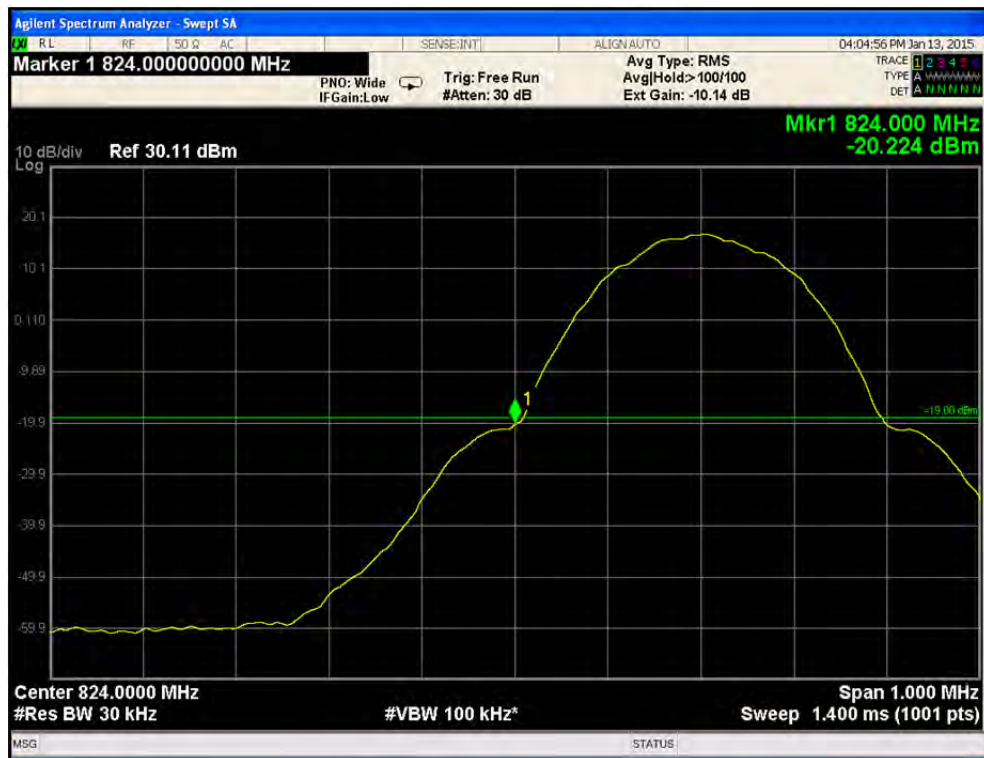
- Band 5 / Downlink / Lower side / AWGN



- Band 5 / Downlink / Upper side / AWGN



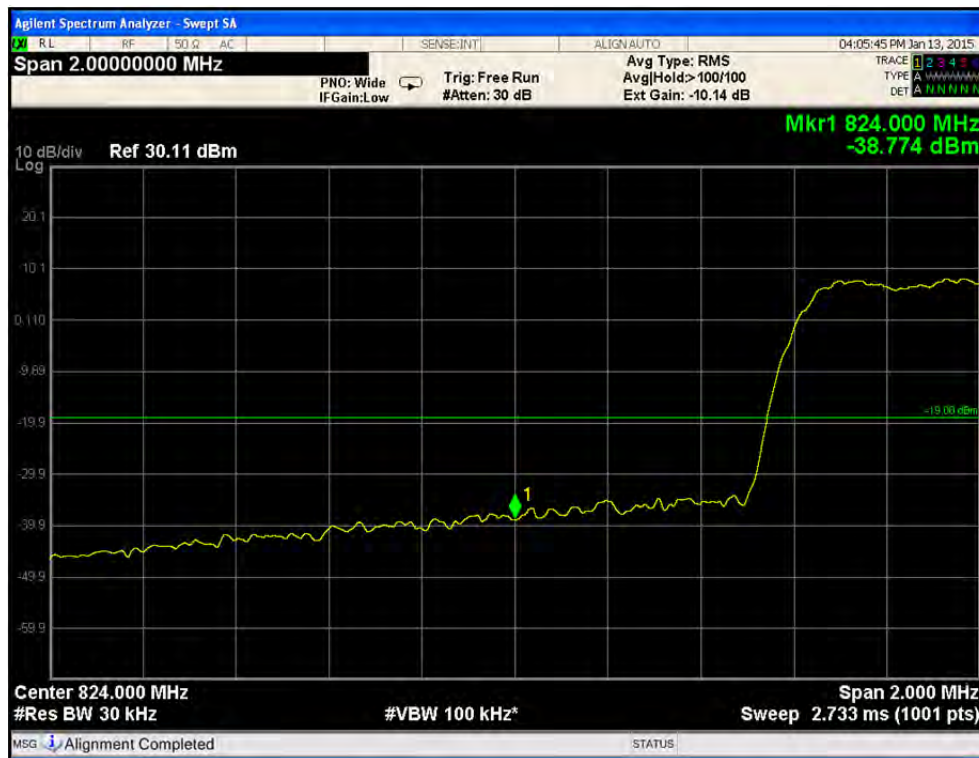
- Band 5 / Uplink / Lower side / GSM



- Band 5 / Uplink / Upper side / GSM



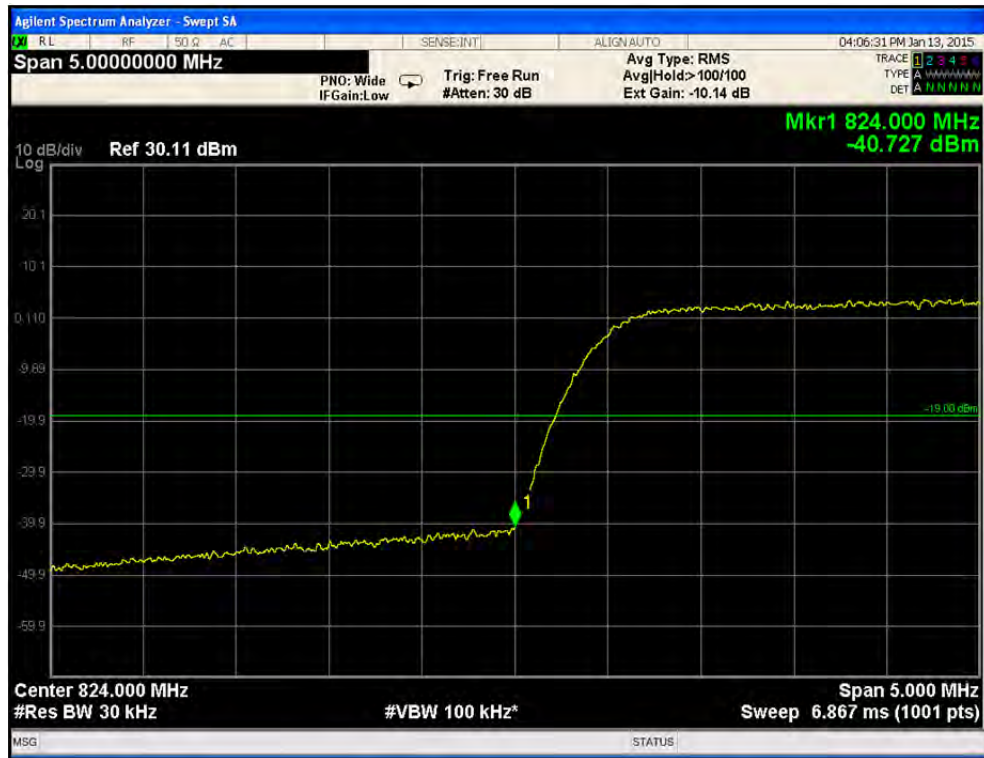
- Band 5 / Uplink / Lower side / CDMA



- Band 5 / Uplink / Upper side / CDMA



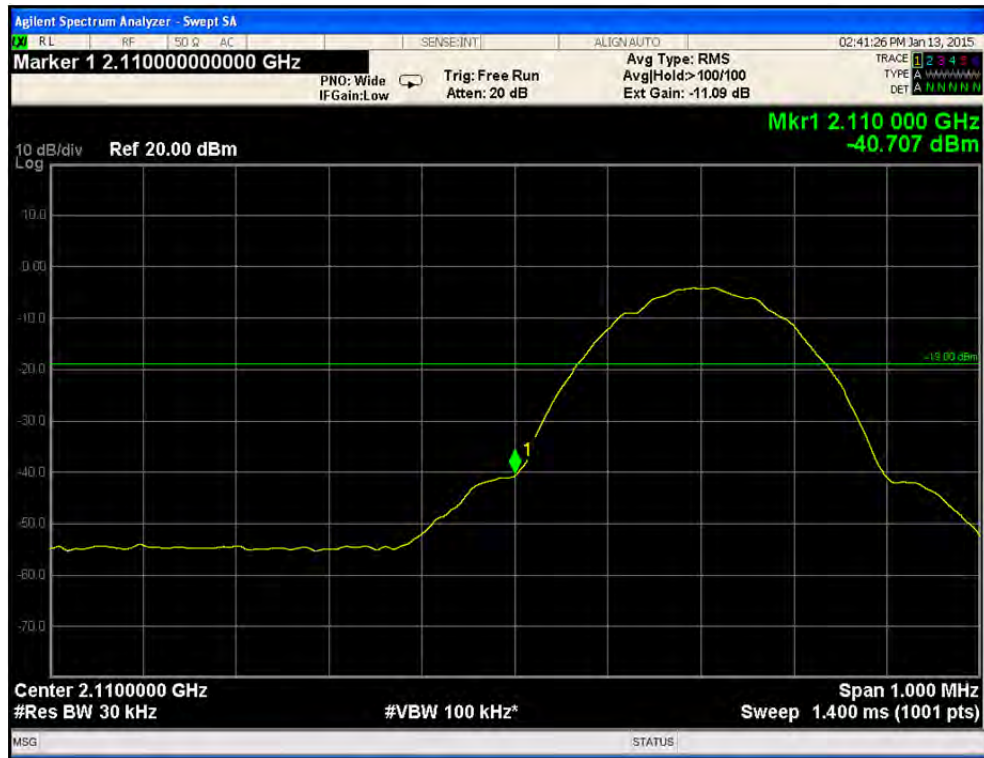
- Band 5 / Uplink / Lower side / AWGN



- Band 5 / Uplink / Upper side / AWGN



- Band 4 / Downlink / Lower side / GSM

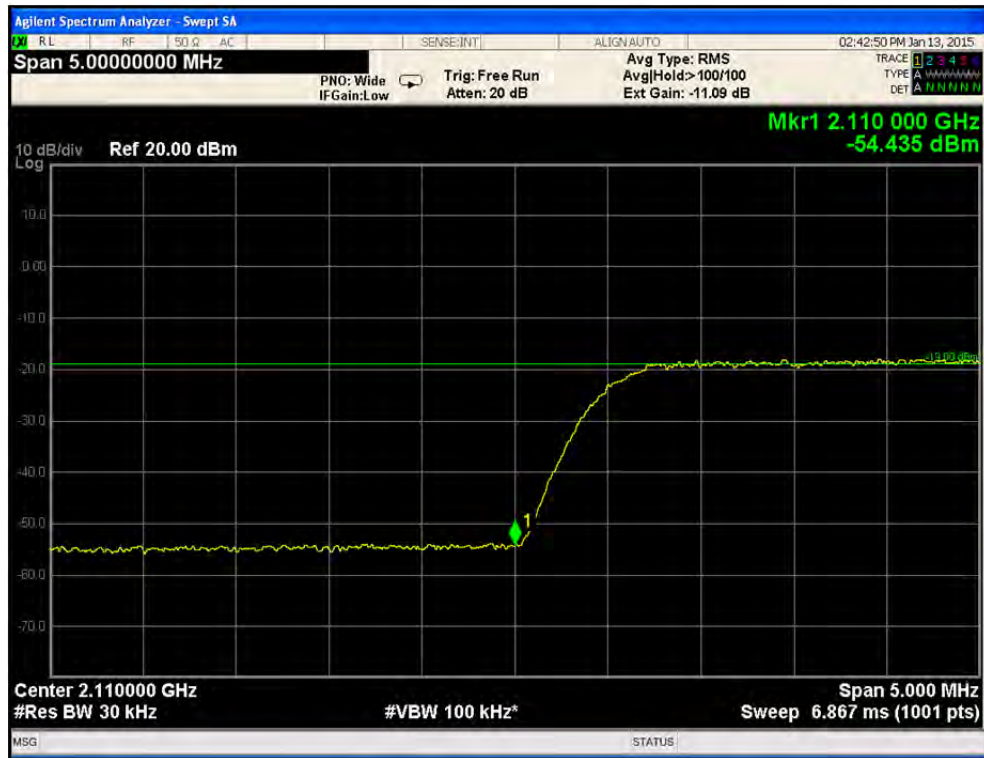


- Band 4 / Downlink / Upper side / GSM



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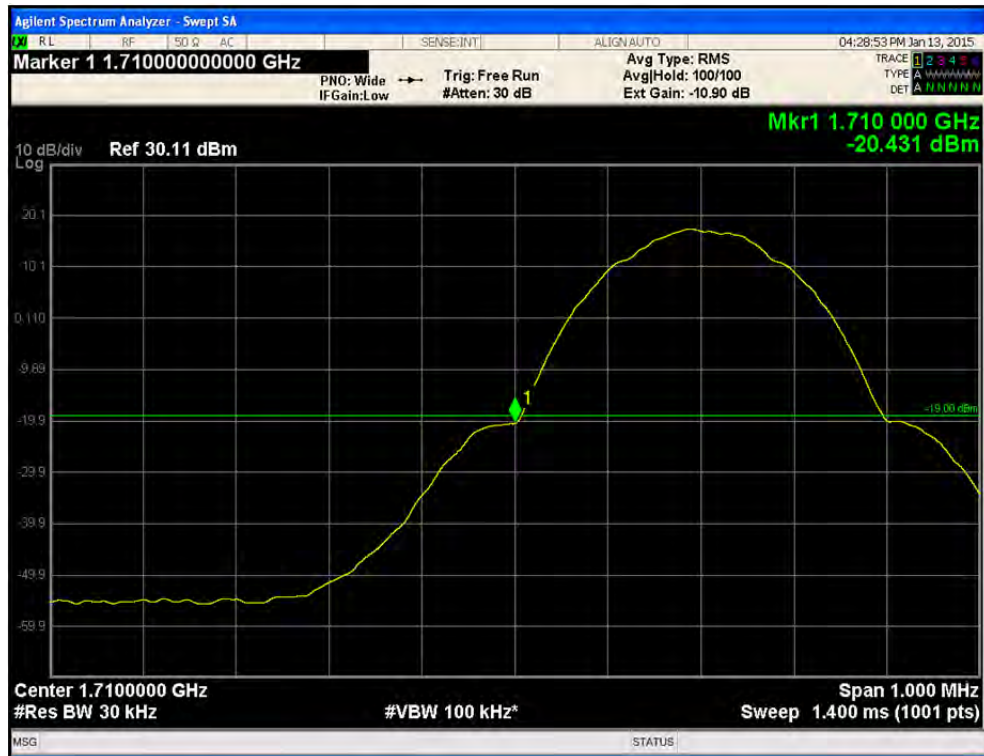
- Band 4 / Downlink / Lower side / AWGN



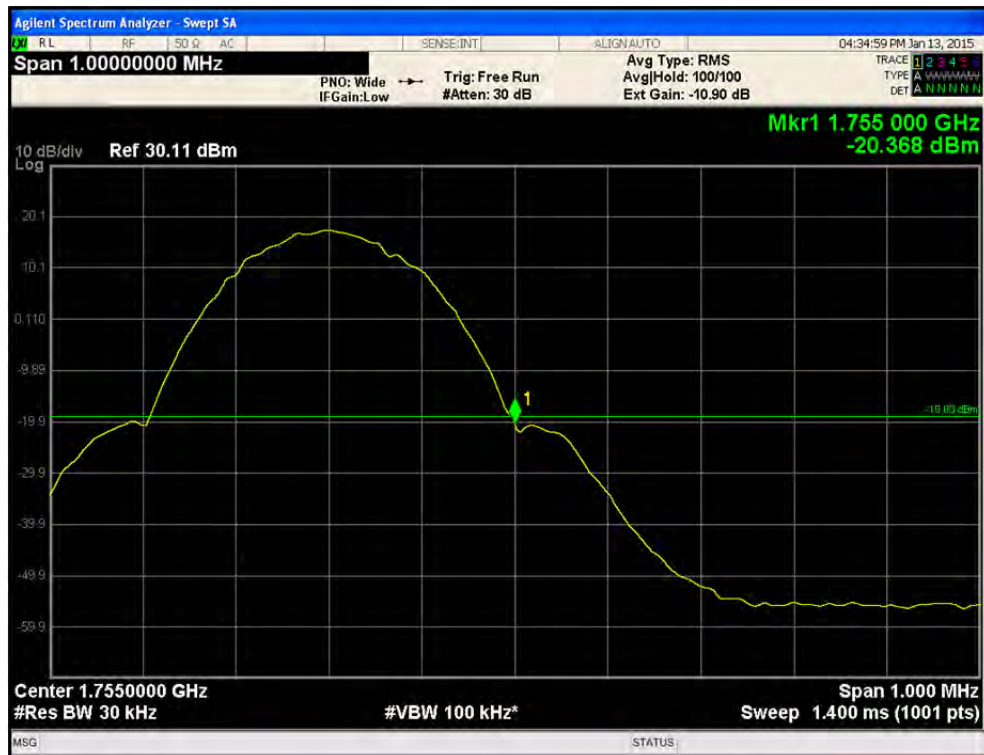
- Band 4 / Downlink / Upper side / AWGN



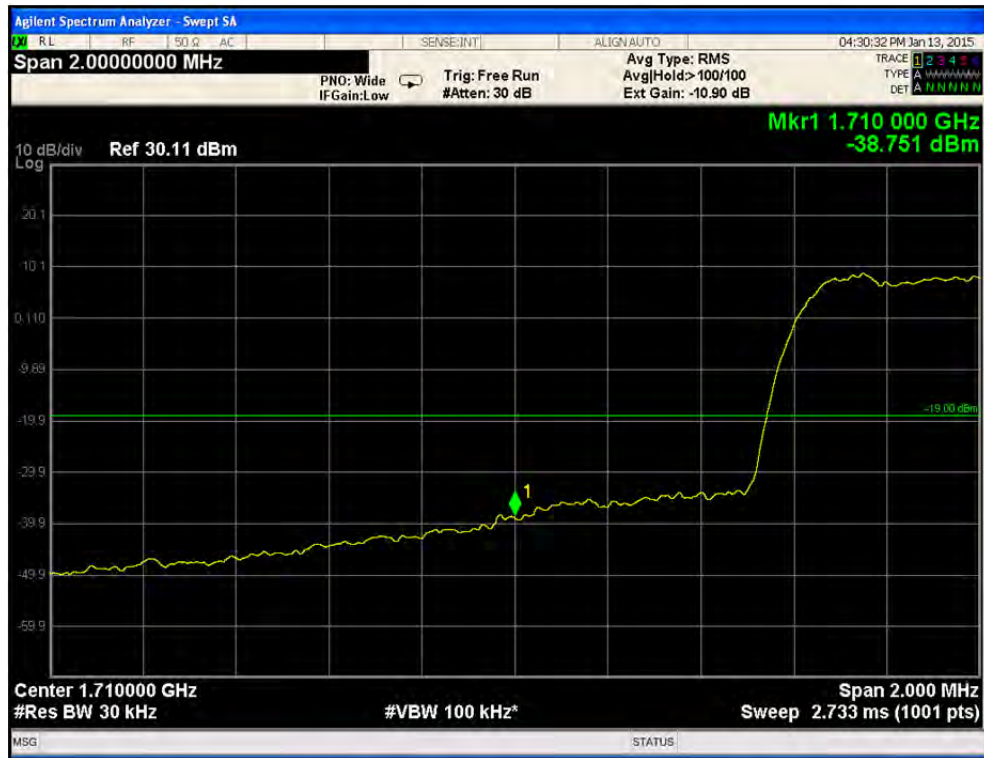
- Band 4 / Uplink / Lower side / GSM



- Band 4 / Uplink / Upper side / GSM



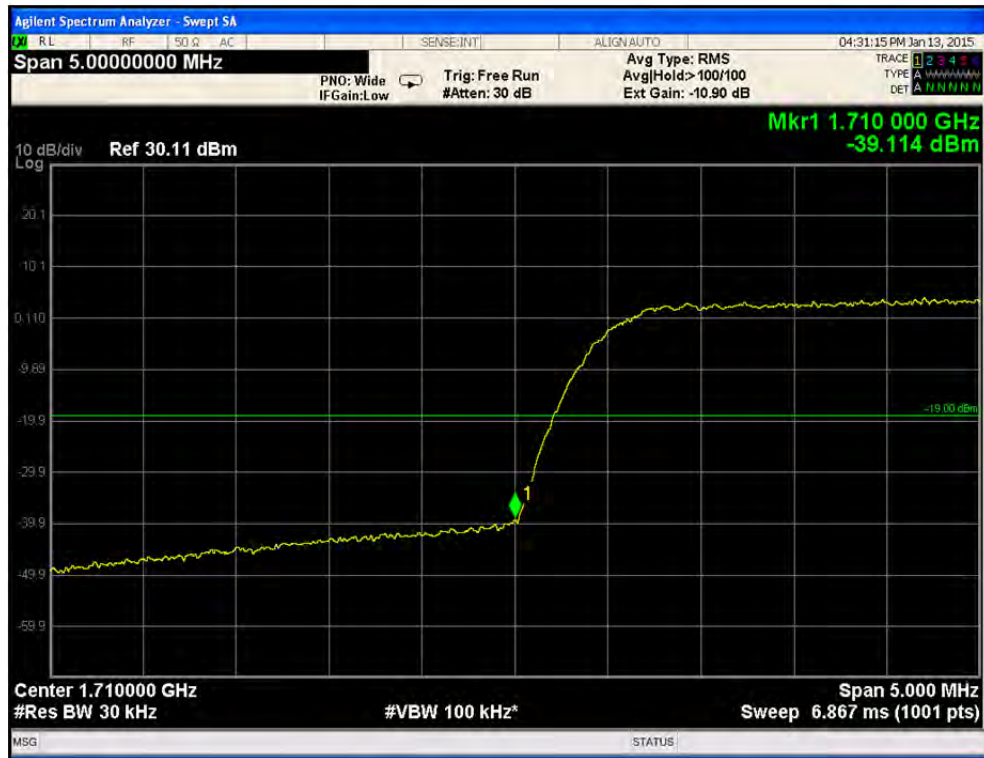
- Band 4 / Uplink / Lower side / CDMA



- Band 4 / Uplink / Upper side / CDMA



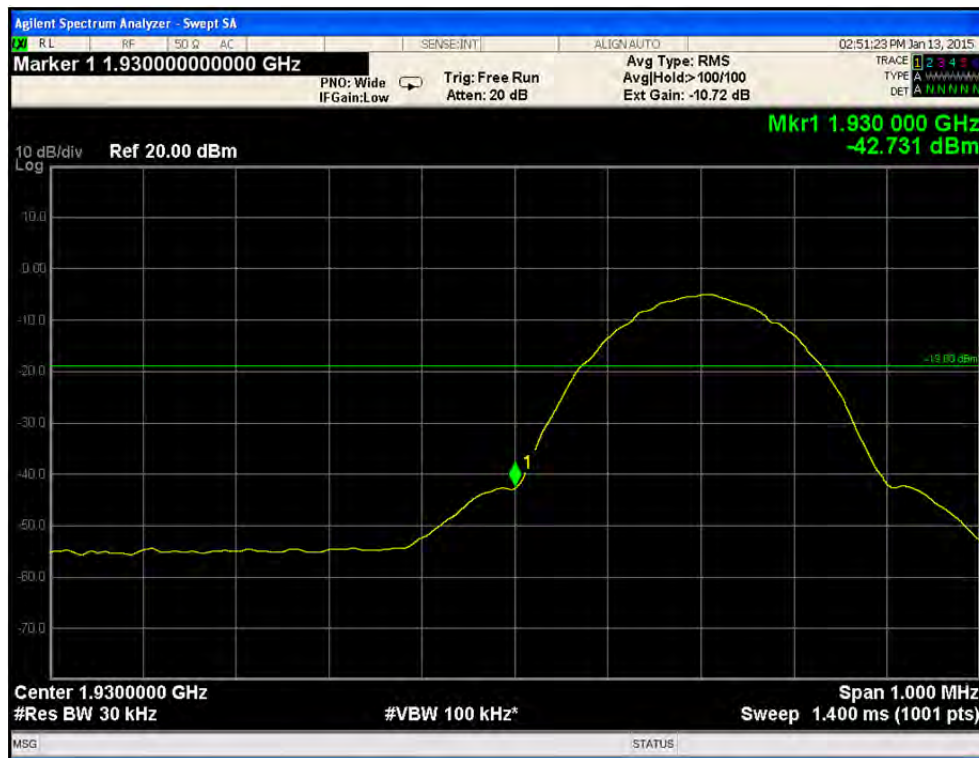
- Band 4 / Uplink / Lower side / AWGN



- Band 4 / Uplink / Upper side / AWGN



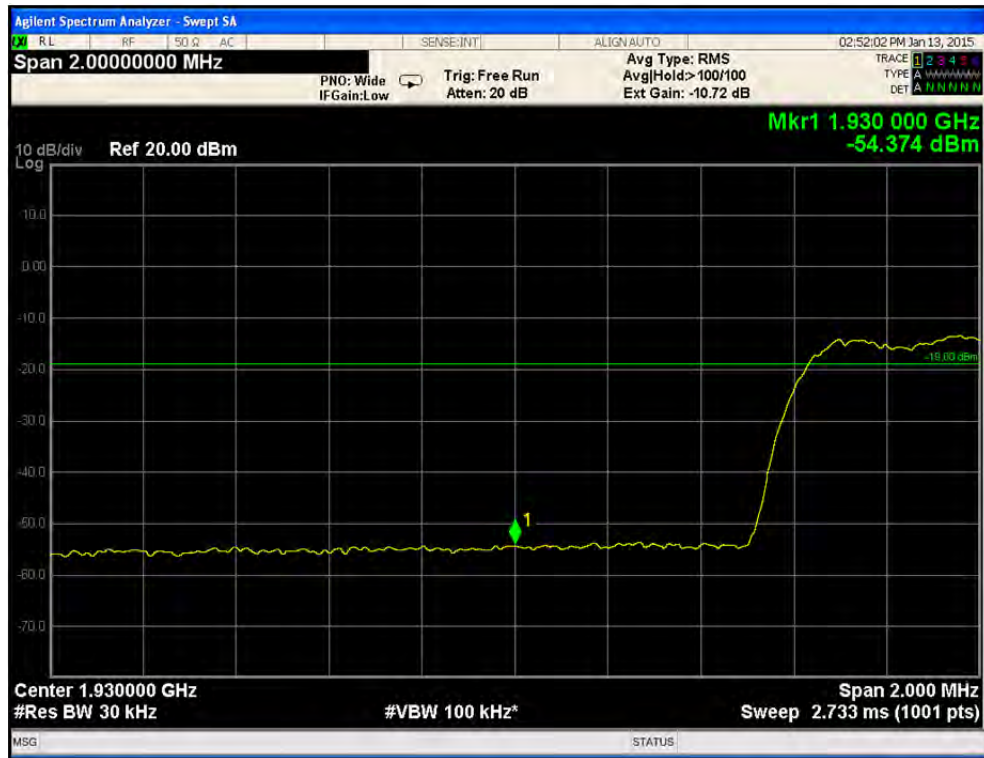
- Band 25/ Downlink / Lower side / GSM



- Band 25/ Downlink / Upper side / GSM



- Band 25/ Downlink / Lower side / CDMA



- Band 25/ Downlink / Upper side / CDMA



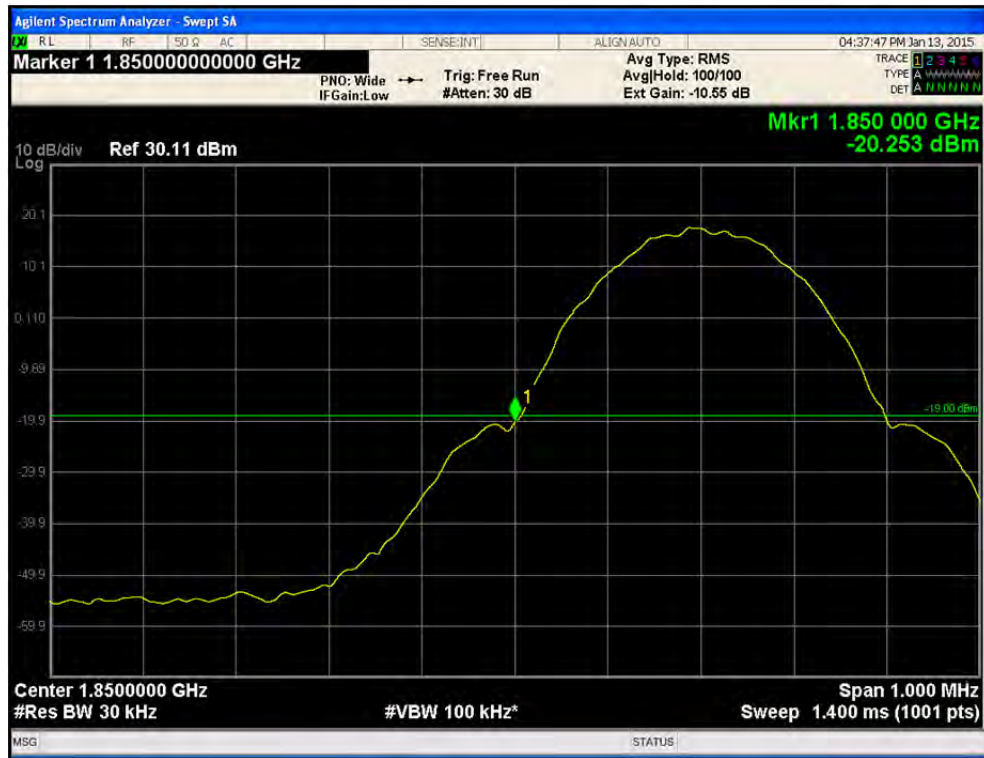
- Band 25/ Downlink / Lower side / AWGN



- Band 25/ Downlink / Upper side / AWGN



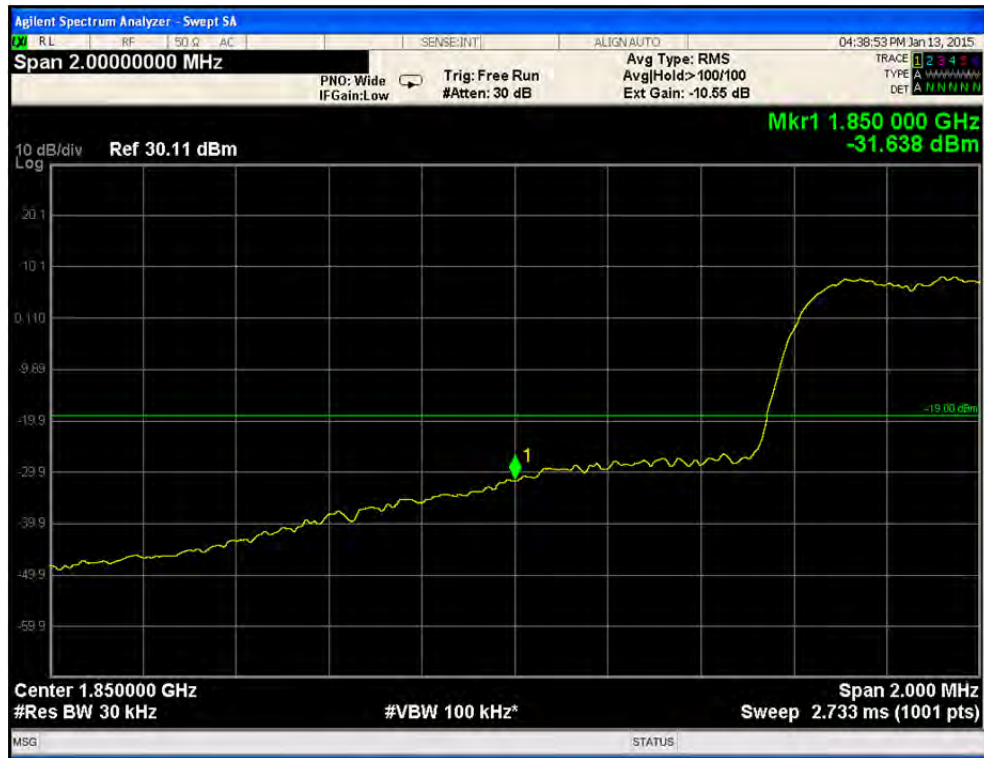
- Band 25/ Uplink / Lower side / GSM



- Band 25/ Uplink / Upper side / GSM



- Band 25/ Uplink / Lower side / CDMA



- Band 25/ Uplink / Upper side / CDMA



- Band 25/ Uplink / Lower side / AWGN



- Band 25/ Uplink / Upper side / AWGN



3.6 Conducted spurious emission

3.6.1 Specification

- FCC Rules Part 2 Section 2.1051
- FCC Rules Part 22 Subpart H, Section 22.917
- FCC Rules Part 24 Subpart E, Section 24.238
- FCC Rules Part 27 Subpart C, Section 27.53

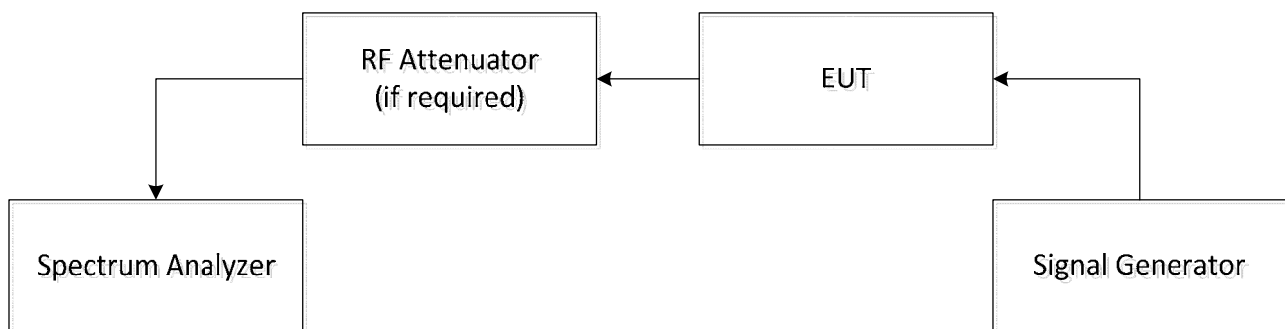
3.6.2 Measurement method

- 935210 D03 Signal Booster Measurement v02r01
- a) Connect the EUT to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer.
 - b) Configure the signal generator for AWGN with a 99% occupied bandwidth of 4.1 MHz operation 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 Maximum power.
 - d) Turn on the signal generator RF output and measure the spurious emission power levels with an appropriate measurement instrument as follows.
 - e) Set RBW = measurement bandwidth specified in the applicable rule section for the operational frequency band under consideration (see Annex 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) to enhance measurement accuracy, but the result must then be integrated over the specified measurement bandwidth.
 - f) Set VBW = 3 X RBW.
 - g) Select the power averaging (RMS) detector. (See above note regarding the use of a peak detector for preliminary measurements.)
 - h) Sweep time = auto-couple.
 - i) 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 $\geq (2 \times \text{span}/\text{RBW})$ 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. Trace average at least 10 traces in power averaging (i.e., RMS) mode.
 - j) 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.
 - k) 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 $\geq (2 \times \text{span}/\text{RBW})$ 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.
 - l) 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.
 - m) Repeat steps b) through l) for each supported frequency band of operation.

3.6.3 Limit

- §2.1053, Conducted emissions limit = $43 + 10 \log (P) = -13 \text{ dBm}$
- §27.53(c), For operations in the 746-758 MHz band and the 776-788 MHz band
On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log (P) \text{ dB}$ in a 6.25 kHz band segment, for base and fixed stations
- §27.53(e), For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands
Emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

3.6.4 Set-Up



3.6.5 Test equipment list

Equipment	Model Name	Manufacturer
EUT	USHR-781921-5B	OPISYS Incorporated
Signal Generator	E4432B	Agilent
Spectrum Analyzer	N9020A	Agilent
Spectrum Analyzer	FSV	R&S
Attenuator	AF115A-09-34	Weinschel

3.6.6 Test condition

- Test place: Shield Room
- Test environment: 23.0 °C, 44 % R.H.

3.6.7 Test results

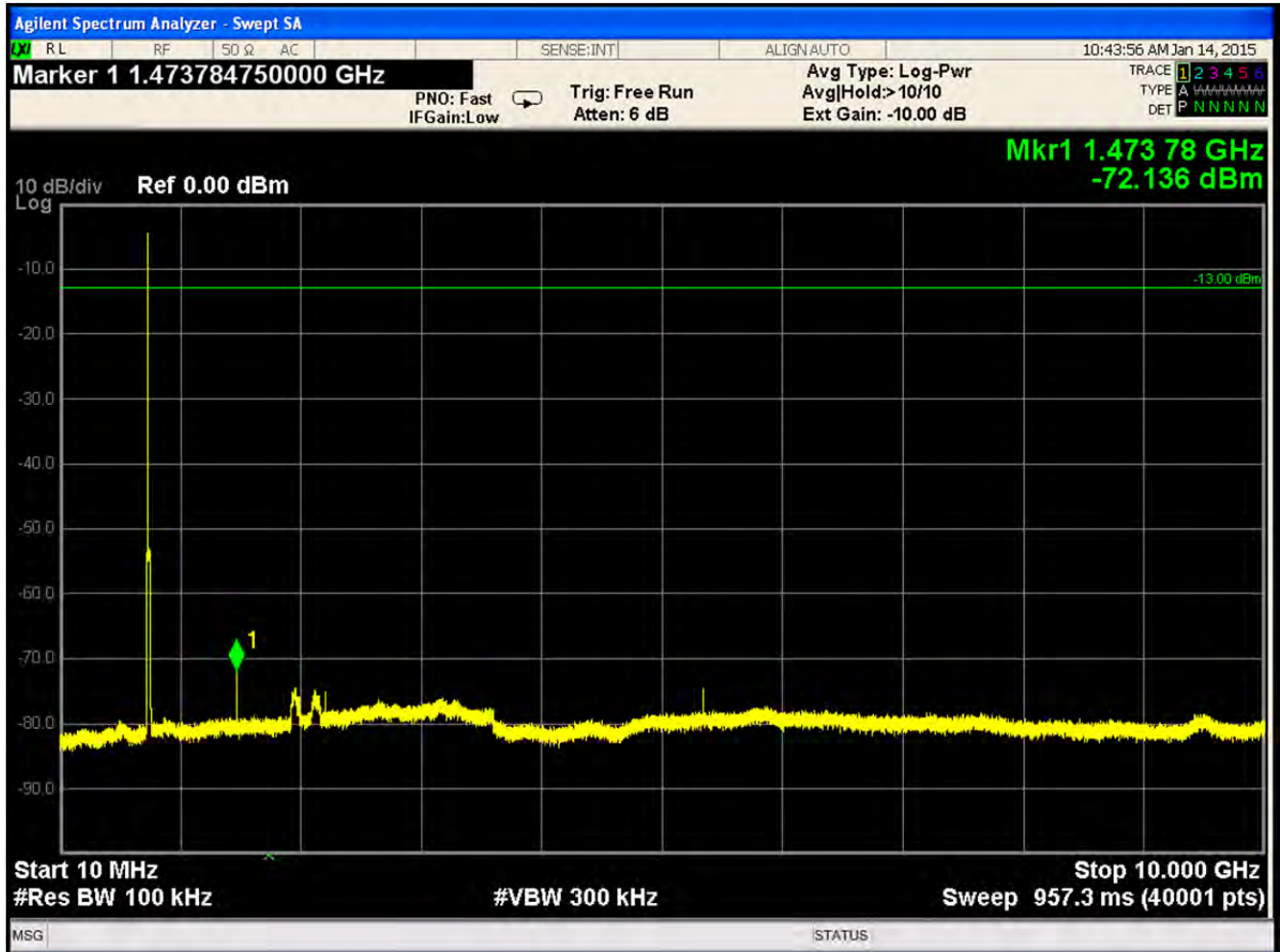
- Spurious emissions

Band	Link	Operation frequency [MHz]	Frequency range of spurious emission [MHz]	Level of spurious emission [dBm]	RBW [kHz]	Limit [dBm]
Band 12	Downlink	737.0	10 to 10 000	-72.13	100	-13.0
	Uplink	707.0		-48.22	100	
Band 13	Downlink	751.5	10 to 10 000	-72.28	100	-13.0
	Uplink	781.5		-45.19	100	
	Downlink	751.5	763 to 775	Not found	6.25	-46.0
	Uplink	781.5		-63.35	6.25	
	Downlink	751.5	793 to 805	Not found	6.25	-46.0
	Uplink	781.5		-65.46	6.25	
	Downlink	751.5	1 559 to 1 610	-72.71	1 000	-40.0
	Uplink	781.5		-43.21	1 000	
Band 5	Downlink	881.5	10 to 10 000	-72.12	100	-13.0
	Uplink	836.5		-42.74	100	
Band 4	Downlink	2132.5	10 to 30 000	-67.34	100	
	Uplink	1732.5		-46.83	100	
Band 25	Downlink	1962.5	10 to 30 000	-55.55	100	
	Uplink	1882.5		-35.73	100	

※ Bandwidth correction factor = $10\log(10/6.25) = 2.0$ dB

3.6.8 Plots of spurious emissions

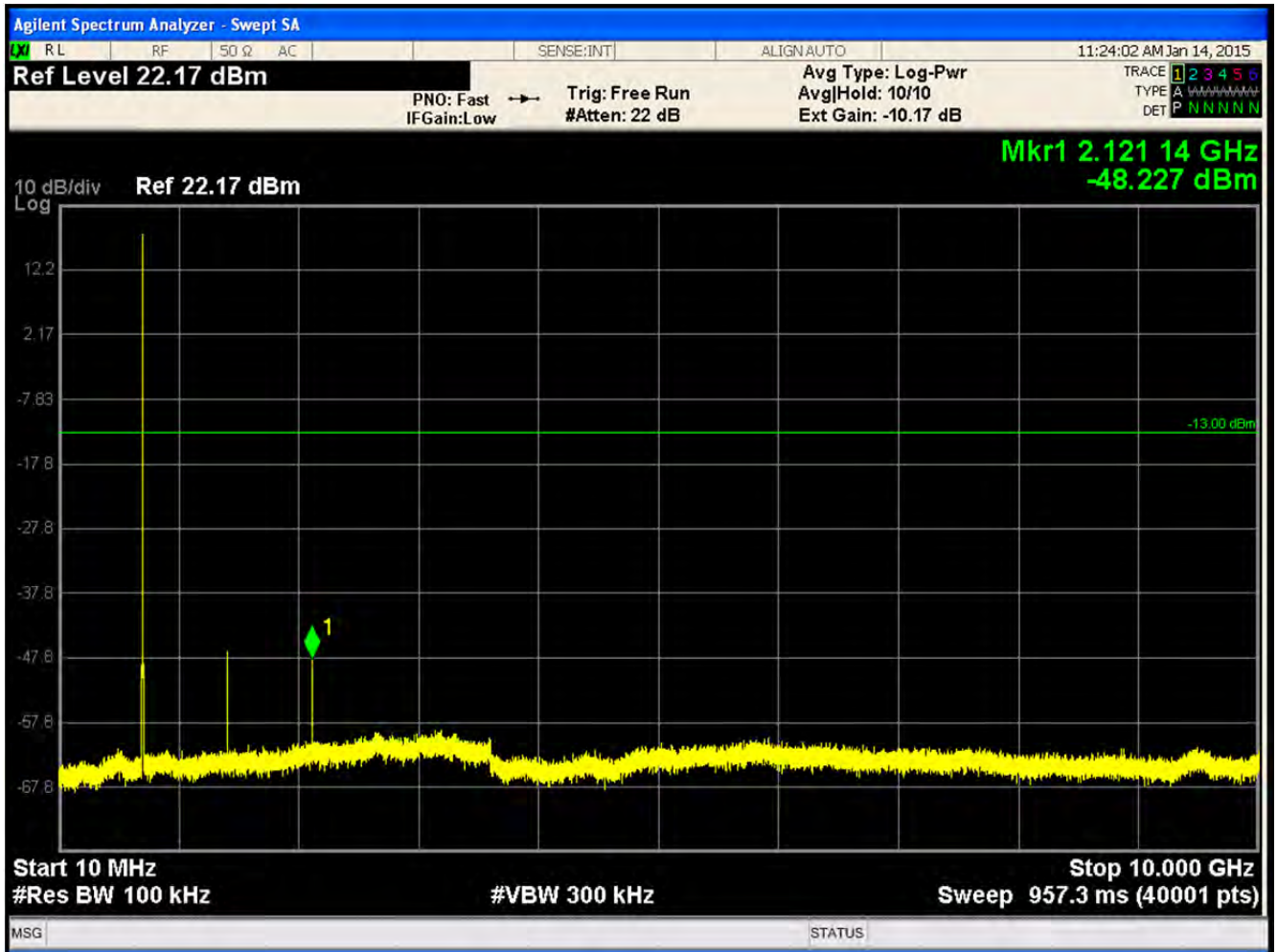
- Band 12 / Downlink / 737 MHz / 10 MHz to 10 GHz



Operating frequency : 737 MHz
RBW : 100 kHz
VBW : 300 kHz
Detector mode : Peak
Trace mode : Average
Emission range : 10 MHz to 10 GHz

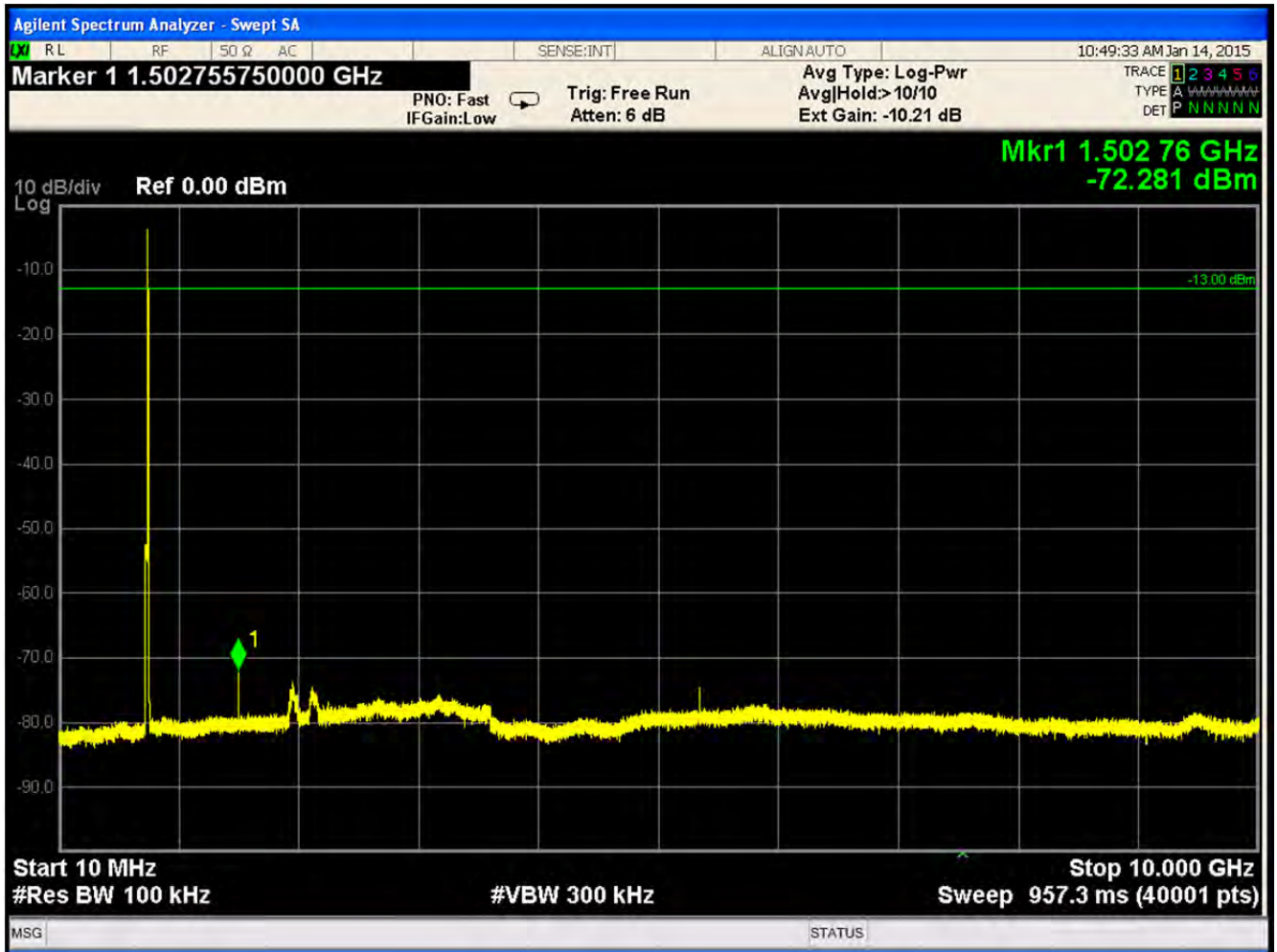
Emission : -72.13 dBm

• Band 12 / Uplink / 707 MHz / 10 MHz to 10 GHz



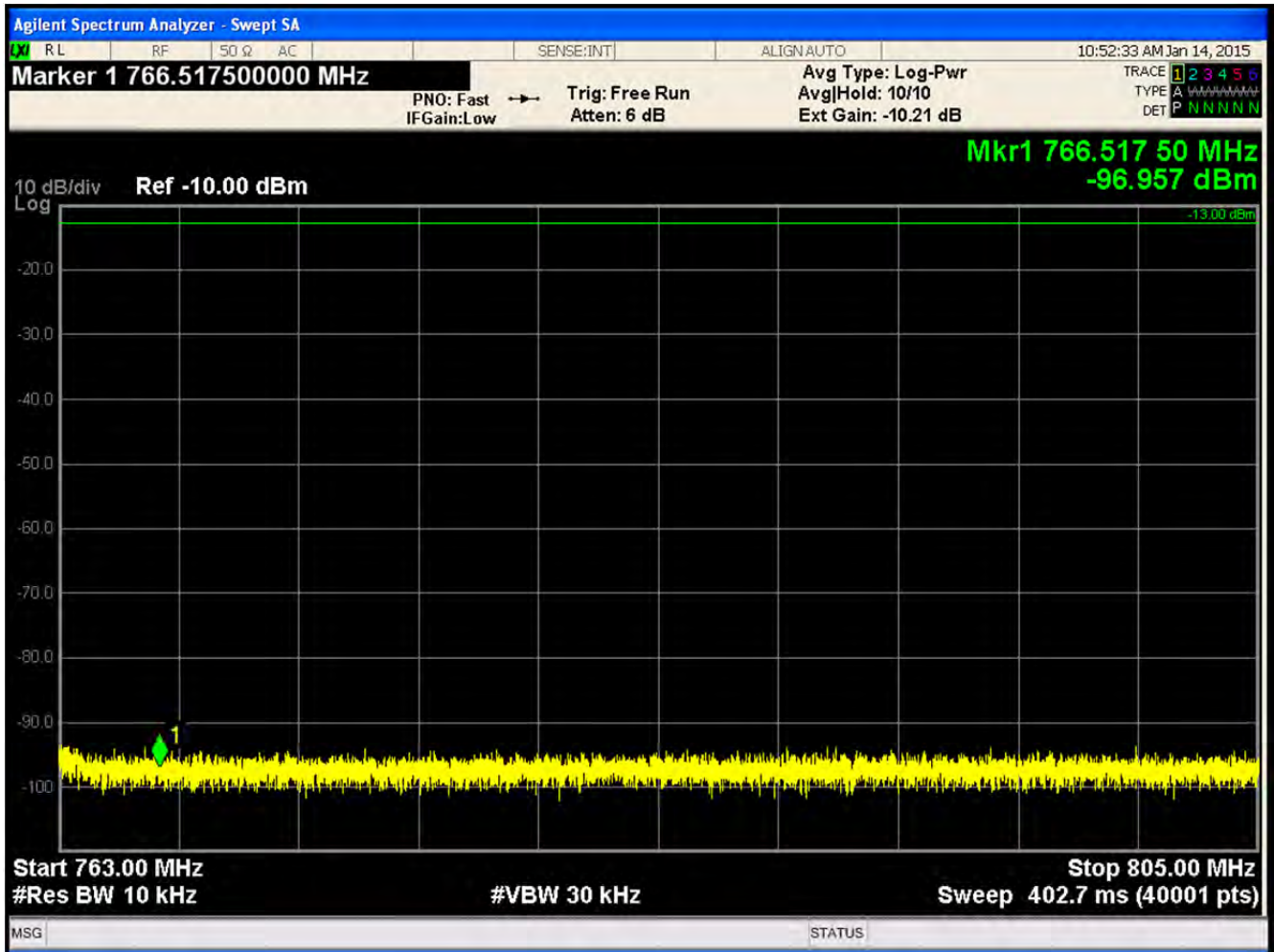
Operating frequency : 707 MHz
 RBW : 100 kHz
 VBW : 300 kHz
 Detector mode : Peak
 Trace mode : Average
 Emission range : 10 MHz to 10 GHz
 Emission : -48.22 dBm

• Band 13 / Downlink / 751.5 MHz / 10 MHz to 10 GHz



Operating frequency : 751.5 MHz
RBW : 100 kHz
VBW : 300 kHz
Detector mode : Peak
Trace mode : Average
Emission range : 10 MHz to 10 GHz
Emission : -72.28 dBm

• Band 13 / Downlink / 751.5 MHz / 763 MHz to 805 MHz

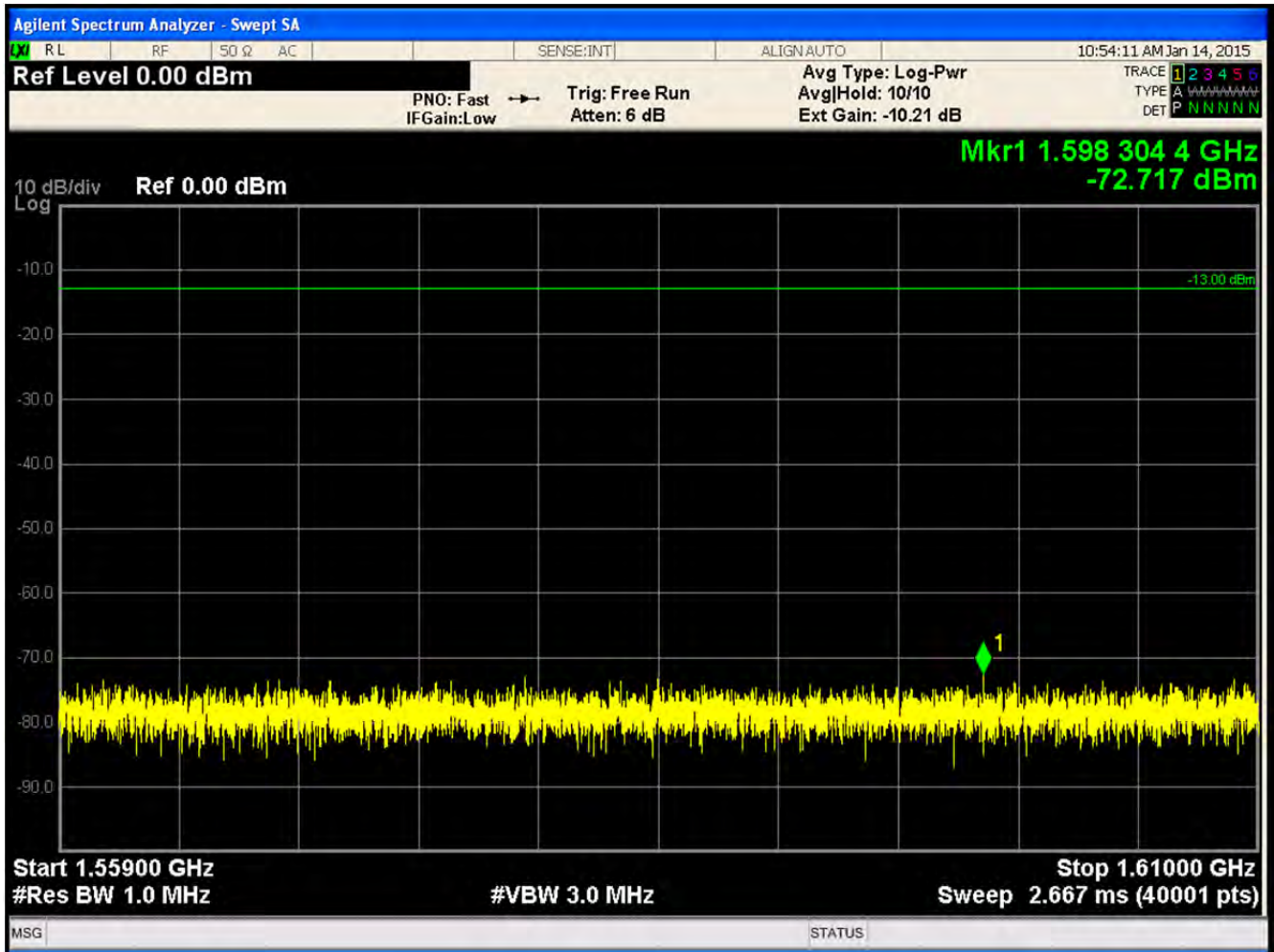


Operating frequency : 751.5 MHz
 RBW : 10 kHz
 VBW : 30 kHz
 Detector mode : Peak
 Trace mode : Average
 Emission range : 763 MHz to 805 MHz
 Emission : Not found

✳ 76+ 10*log(20W/1W) dB => -46 dBm in a 6.25 kHz band segment.

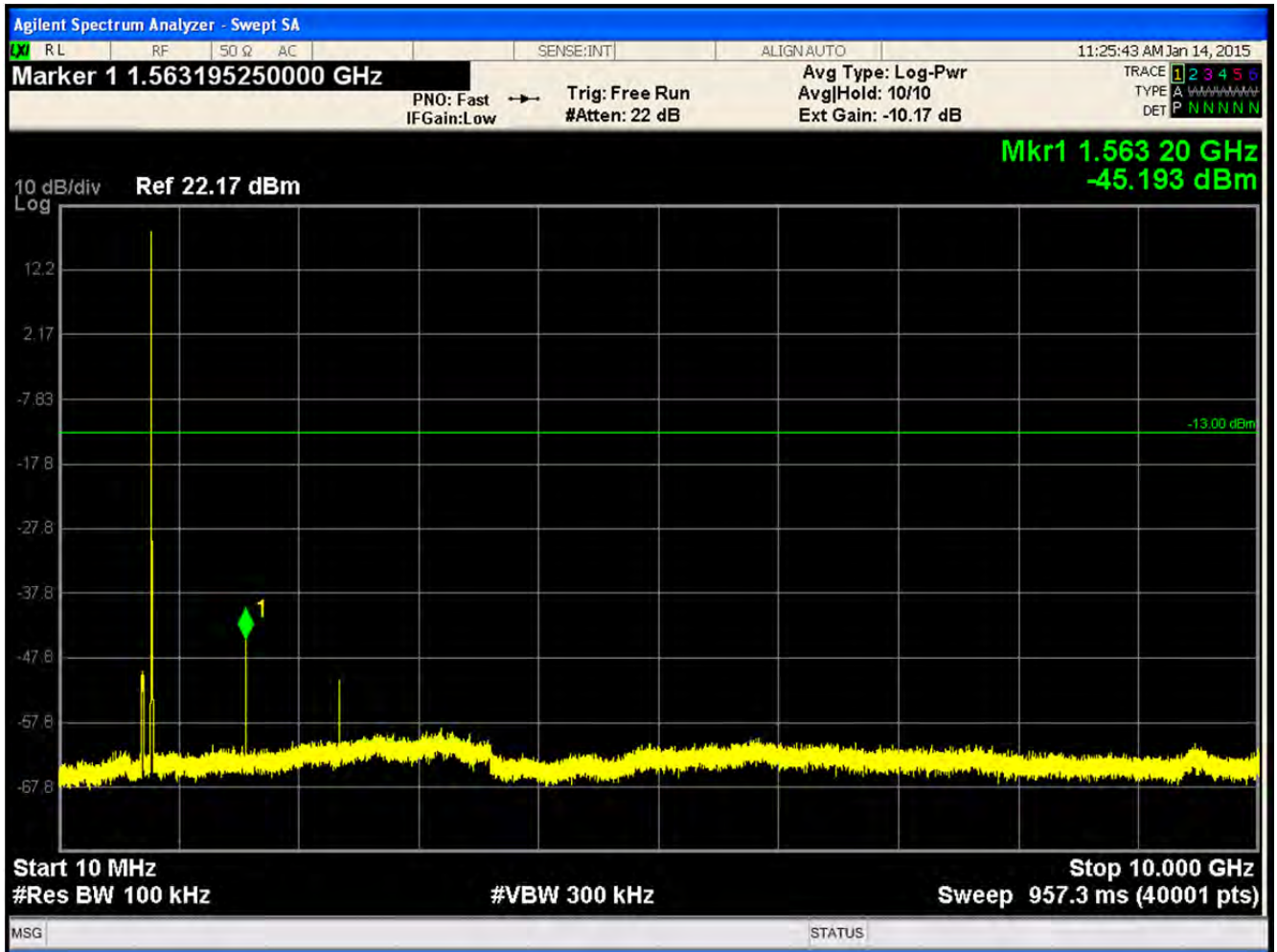
Spurious measured in the plot with a RBW of 10 kHz so the limit is calculated:
 $-46\text{dBm} / 6.25 \text{ kHz} + 10 \cdot \log(10 \text{ kHz} / 6.25 \text{ kHz}) = -44 \text{ dBm} / 10 \text{ kHz}$

• Band 13 / Downlink / 751.5 MHz / 1 559 MHz to 1 610 MHz



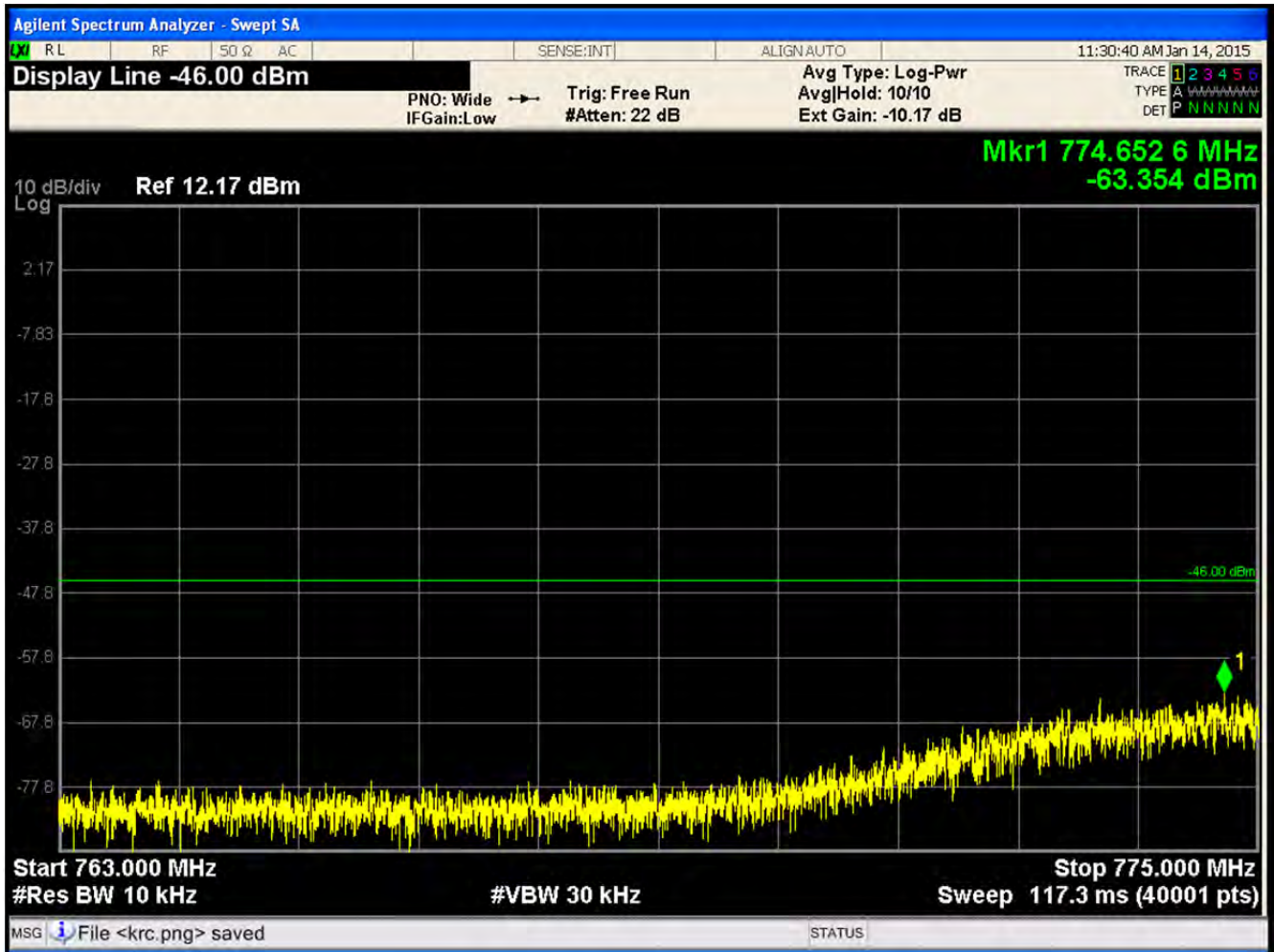
Operating frequency : 751.5 MHz
RBW : 1 MHz
VBW : 3 MHz
Detector mode : Peak
Trace mode : Average
Emission range : 1 559 MHz to 1 610 MHz
Emission : -72.71 dBm

• Band 13 / Uplink / 781.5 MHz / 10 MHz to 10 GHz



Operating frequency : 781.5 MHz
 RBW : 100 kHz
 VBW : 300 kHz
 Detector mode : Peak
 Trace mode : Average
 Emission range : 10 MHz to 10 GHz
 Emission : -45.19 dBm

• Band 13 / Uplink / 781.5 MHz / 763 MHz to 775 MHz

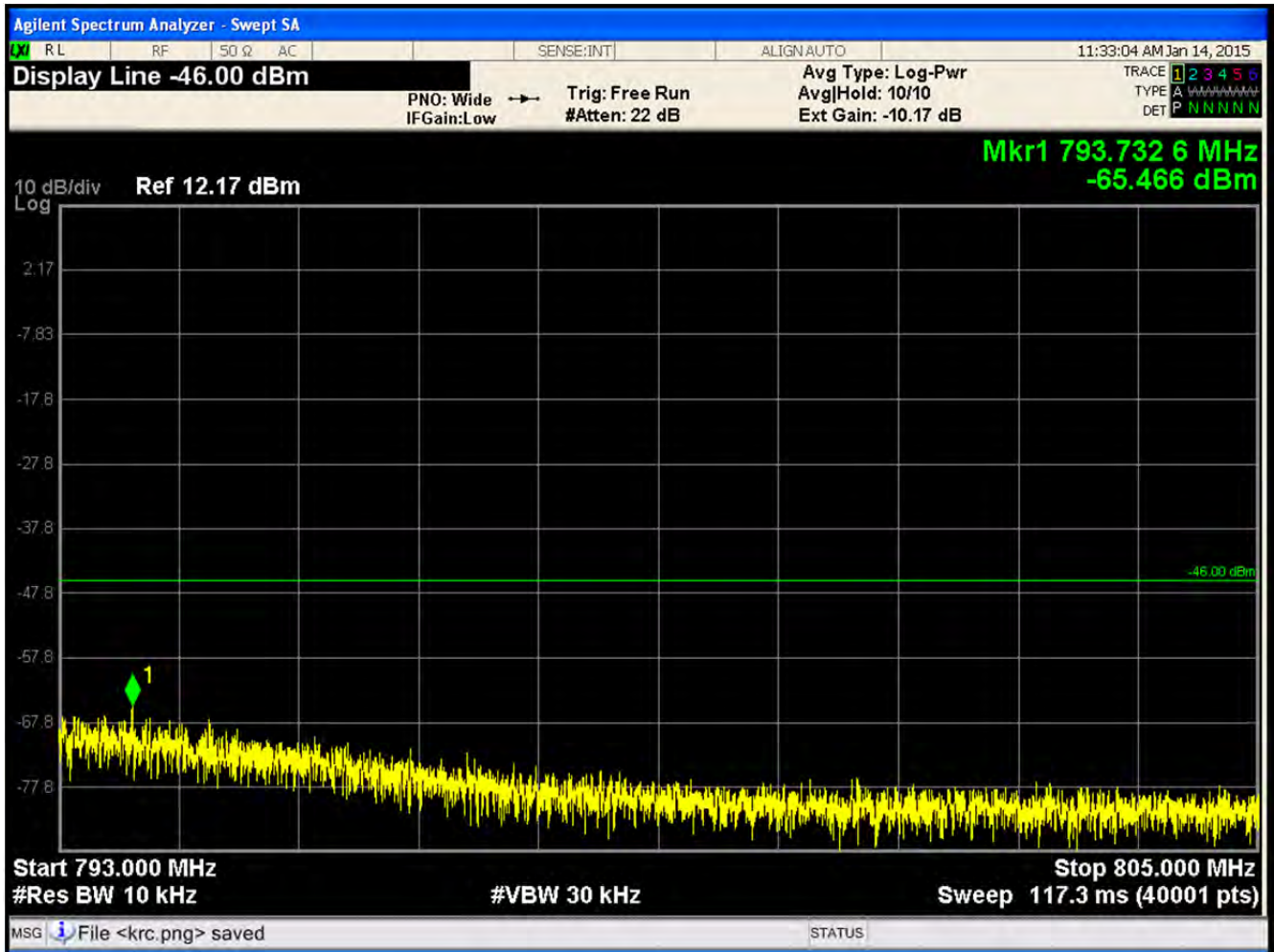


Operating frequency : 781.5 MHz
RBW : 10 kHz
VBW : 30 kHz
Detector mode : Peak
Trace mode : Average
Emission range : 763 MHz to 775 MHz
Emission : -63.35 dBm

※ $76 + 10 \cdot \log(20W/1W)$ dB => -46 dBm in a 6.25 kHz band segment.

Spurious measured in the plot with a RBW of 10 kHz so the limit is calculated:
 $-46\text{dBm} / 6.25 \text{ kHz} + 10 \cdot \log(10 \text{ kHz} / 6.25 \text{ kHz}) = -44 \text{ dBm} / 10 \text{ kHz}$

• Band 13 / Uplink / 781.5 MHz / 793 MHz to 805 MHz



Operating frequency : 781.5 MHz
 RBW : 10 kHz
 VBW : 30 kHz
 Detector mode : Peak
 Trace mode : Average
 Emission range : 793 MHz to 805 MHz
 Emission : -65.46 dBm

※ $76 + 10 \cdot \log(20W/1W)$ dB => -46 dBm in a 6.25 kHz band segment.

Spurious measured in the plot with a RBW of 10 kHz so the limit is calculated:
 $-46 \text{ dBm} / 6.25 \text{ kHz} + 10 \cdot \log(10 \text{ kHz} / 6.25 \text{ kHz}) = -44 \text{ dBm} / 10 \text{ kHz}$