HCT CO., LTD.

CERTIFICATION DIVISION
105-1, JANGAM-RI, MAJANG-MYEON, ICHEON-SI, GYEONGGI-DO, KOREA
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CERTIFICATE OF COMPLIANCE

FCC PART 27 Certification

Applicant Name: **GS Instruments Co.,Ltd.** **Address: 1385-14, Juan-Dong, Nam-Ku, Incheon, 402-200, Korea**	**Date of Issue: November 12, 2012** **Test Site/Location:** HCT CO., LTD., 105-1, Jangam-ri, Majang-Myeon, Icheon-si, Gyeonggi-Do, Korea **Test Report No.:** HCTR1210FR15-1 **HCT FRN:** 0005866421 **IC Recognition No.:** 5944A-3

FCC ID	:	**U88-SMT-L33**
IC	:	**8137A-SMT-L33**
APPLICANT	:	**GS Instruments Co.,Ltd.**

EUT Type:	**LTE In-Building RF Repeater**
Model:	**SMT-L33**
Frequency Ranges:	**DL : 728 MHz ~ 740 MHz, 746 MHz ~ 757 MHz** **UL : 698 MHz ~ 710 MHz, 776 MHz ~ 787 MHz**
Conducted Output Power:	**DL : 2.04 W , UL : 2.05 W**
FCC Rules Part(s):	**CFR 47, Part 27**
IC Rules Part(s):	**RSS-131, RSS-GEN**

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 27 of the FCC Rules under normal use and maintenance.

Report prepared by
:Chang Seok Choi
Test engineer of RF Team

Approved by
: Sang Jun Lee
Manager of RF Team

Revision

TEST REPORT NO.	DATE	DESCRIPTION
HCTR1210FR15	October 11, 2012	First Approval Report
HCTR1210FR15-1	November 12, 2012	Some comments for KDB935210 were added.

CONTENTS

1. CLIENT INFORMATION

The EUT has been tested by request of

Company	GS Instrumnets Co.,Ltd. 1385-14, Juan-Dong, Nam-Ku, Incheon, 402-200, Korea
Contact Point	Attention: Young Il Kim Tel. : +82-32-870-5545

■ **FCC ID:**	**U88-SMT-L33**
■ **APPLICANT:**	**GS Instruments Co.,Ltd.**
■ **EUT Type:**	**LTE In-Building RF Repeater**
■ **Model:**	**SMT-L33**
■**Frequency Ranges:**	**DL : 728 MHz ~ 740 MHz, 746 MHz ~ 757 MHz** **UL : 698 MHz ~ 710 MHz, 776 MHz ~ 787 MHz**
■ **Conducted Output Power:**	**DL : 33.11 dBm** **UL : 33.12 dBm**
■ **Antenna Gain(s):**	**DL : 2 dBi , UL : 8 dBi**
■ **FCC Rules Part(s):**	**CFR Title 47 Part 27**
■ **IC Rules Part(s):**	**RSS-131, RSS-GEN**
■ **Place of Tests:**	**105-1, Jangam-ri , Majang-Myeon, Icheon-si, Gyeonggi-Do, 467-811, KOREA. (IC Recognition No. : 5944A-3)**

2. TEST SPECIFICATIONS

Description	Reference (FCC)	Reference (IC)	Results
RF Power Output	§2.1046; §27.50	RSS-131, Section 6.2	Compliant
Occupied Bandwidth Passband Gain	§2.1049	RSS-131, Section 6.1 RSS-GEN, Section 4.6.1	Compliant
Spurious Emissions at Antenna Terminals	§2.1053, §27.53	RSS-131, Section 6.3 RSS-131, Section 6.4	Compliant
Radiated Spurious Emissions	§2.1053, §27.53	-	Compliant
Frequency Stability	§2.1055, §27.54	RSS-131, Section 6.5	Compliant

※ We refered to KDB935210 to test the EUT.

※ According to KDB935210, for spurious emissions and bandwidth both maximum input at the highest gain setting (-57dBm input, 90dB gain) and maximum input level (-27dBm) is checked and the worst case (-57dBm/90dB gain) of the two is contained in the test report

3. STANDARDS ENVIRONMENTAL TEST CONDITIONS

Temperature :	**+ 15 ℃ to + 35 ℃**
Relative humidity:	**30 % to 60 %**
Air pressure	**860 mbar to 1 060 mbar**

4. TEST EQUIPMENT

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Schwarzbeck	BBHA 9120D / Double Ridged Horn Antenna	147	05/15/2014
Schwarzbeck	BBHA 9120D / Double Ridged Horn Antenna	937	10/17/2013
Schwarzbeck	VULB 9168 / TRILOG Antenna	9168-200	02/19/2013
HD	MA240 / Antenna Position Tower	556	N/A
EMCO	1050 / Turn Table	114	N/A
HD GmbH	HD 100 / Controller	13	N/A
HD GmbH	KMS 560 / SlideBar	12	N/A
MITEQ	AMF-6B-180265-35-10P / POWER AMP	667624	04/16/2013
Agilent	N9020A /Signal Analyzer	US46220219	05/02/2013
Agilent	6674A / DC Power Supply	3501A00901	05/02/2013
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
Nang-Yeoul	NY-THR18750 / Temperature Chamber	NY-2009012201A	11/08/2012

5. RF OUTPUT POWER

Test Requirements:

§ 2.1046 Measurements required: RF power output:

§ 2.1046 (a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8).The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

§ 2.1046 (b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters, the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and as applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

§ 2.1046 (c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

§ 27.50 Power limits and duty cycle. (2) Fixed and base stations transmitting a signal in the 746–757 MHz, 758–763 MHz, 776–787 MHz, and 788–793 MHz bands with an emission bandwidth of 1 MHz or less must not exceed an ERP of 1000 watts and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section.

Test Requirements: RSS-131 6.2

The manufacturer's output power rating Prated MUST NOT be greater than Pmean for all types of enhancers.

Additional Power Back-off Condition for Multiple Carrier Operations:

An example of a single carrier operation is a band translator that incorporates an (IF) filter of a passband equal to one channel bandwidth. Another example of a single carrier operation is the use of an enhancer, before the connection to the antenna, to boost a low power transmitter (single carrier) to a higher power.

An example of a multiple carrier operation is the use of an enhancer to amplify off-air signals that contain the wanted carrier and two (or more) adjacent band carriers. If the enhancer passband is wide enough to pass more than the wanted channel bandwidth, the enhancer output

stage will be loaded by the multiple carriers.

Examination: with 3 carrier signals (of assumed equal level), the peak voltage will be 3 times the single carrier voltage. The corresponding Peak Envelope Power (PEP) will be 3^2 times greater than a single carrier or 9/4 = 2.25 times greater than 2 tones PEP. Therefore the permissible wanted signal operating point has to be backed off by 3.5 dB (i.e. **Ppermissible = Prated - 3.5 dB**).

Note 1: All enhancers will be classified in the Radio Equipment List (REL) for a single carrier operation.

Note 2: For a multiple carrier operation, the rating must be reduced by 3.5 dB or more.

Note 3: If there are more than 3 carriers present at the amplifier input point, greater power back-off may be required. This can be examined on a case-by-case basis.

Test Procedures:

As required by 47 CFR 2.1046, RF power output measurements were made at the RF output terminals using an attenuator and spectrum analyzer or power meter. This test was performed in all applicable modulations.

Test Procedures: RSS-131 4.3

4.3.1 Multi-channel Enhancer

The following subscript "o" denotes a parameter at the enhancer output point.

Connect two signal generators to the input of the Device Under Test (DUT), via a proper impedance matching network (and preferably via a variable attenuator) so that the two input signals are equal sinusoids (and can be raised equally).

Connect a dummy load of suitable load rating to the enhancer output point. Connect also a spectrum analyser to this output point via a coupling network and attenuator, so that only a portion of the output signal is coupled to the spectrum analyser. The coupling attenuation shall be stated in the test report.

Set the two generator frequencies f1 and f2 such that they and their third-order intermodulation product frequencies, f3= 2f1-f2 and f4 = 2f2 - f1, are all within the passband of the DUT.

Raise the input level to the DUT while observing the output tone levels, Po1 and Po2, and the intermodulation product levels, Po3 and Po4.

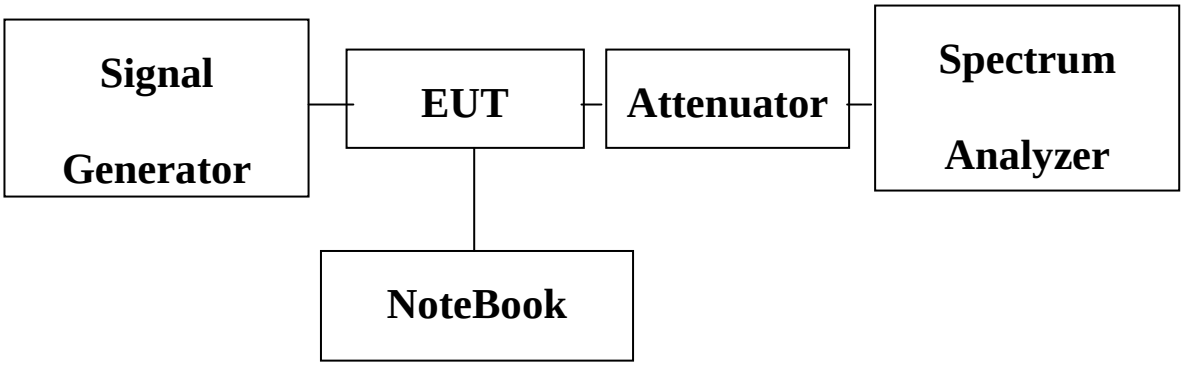
For enhancers rated 500 watts or less: Raise the input level to the DUT until the greater level of the intermodulation products at the enhancer output terminals, Po3 or Po4, equals -43 dBW.

For enhancers rated over 500 watts: Raise the input level to the DUT until the greater level of the intermodulation products at the enhancer output terminals, Po3 or Po4, is 67 dB below the level of either output tone level, Po1 or Po2.

Record all signal levels and their frequencies. Calculate the mean output power (Pmean) under this testing condition using Pmean = Po1 + 3 dB.

4.3.2 Single Channel Enhancer

A suitably modulated signal, representative of the technology for which certification is sought, is applied to the input of the amplifier. The input power level is increased until the manufacturer's rated input power level is achieved or until a 2 dB increase in input level results in a 1 dB increase in output level (i.e. compression begins). Record the output power in the 99% emission bandwidth using any suitable means.



Block Diagram 1. RF Power Output Test Setup

Test Results:

※ According to KDB935210, both cases (Maximum input rating and Maximum gain setting) were looked at and the test result (Output Power and Spectral Shape) were almost same in uplink and downlink.

If we input a higher value than regulated value, the EUT is shut down to prevent itself.

The Test report was recorded the result of maximum gain setting mode only because it was a little worst case for EUT.

Sample Calculation

Output Power = Reading Value + ATT loss + Cable loss

1. Spectrum reading values are not plot data. The power results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss (32.58 dB at downlink, and 33.96 dB at uplink)
3. Actual value of loss for the attenuator and cable combination is 32.58 dB at 737 MHz , 33.96 dB at 782 MHz.

Input Signal	Modulation	Level (dBm)
LTE	64QAM	-56.2

[Downlink]

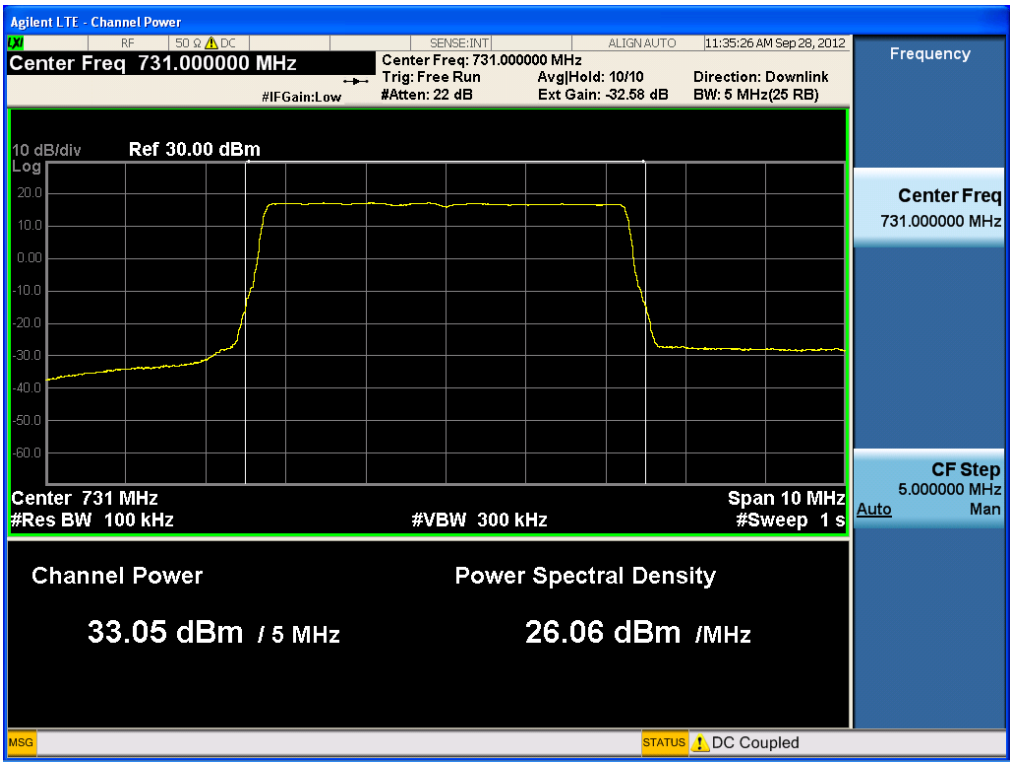
Band	Bandwidth	Frequency (MHz)	Measured Average Output Power (dBm)
A	5 MHz	731	33.05
B		737	33.04
A&B	10 MHz	734	33.11
C		751	33.09

[Uplink]

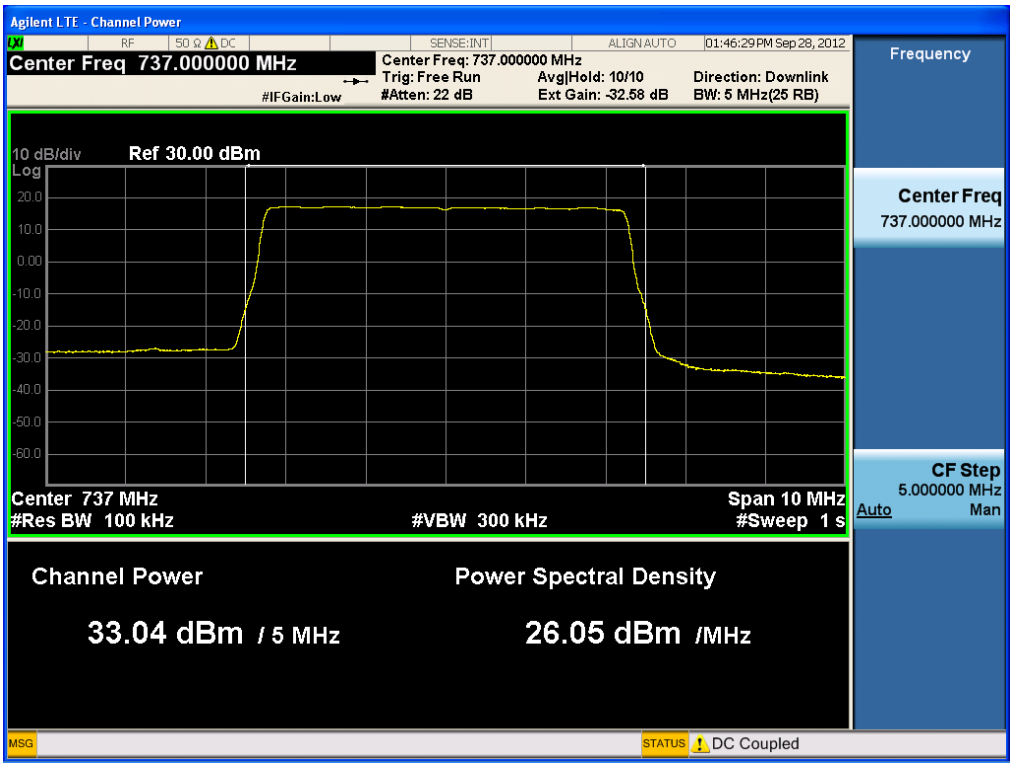
Band	Bandwidth	Frequency (MHz)	Measured Average Output Power (dBm)
A	5 MHz	701	33.04
B		707	33.12
A&B	10 MHz	704	33.07
C		782	33.03

Plots of RF Output Power

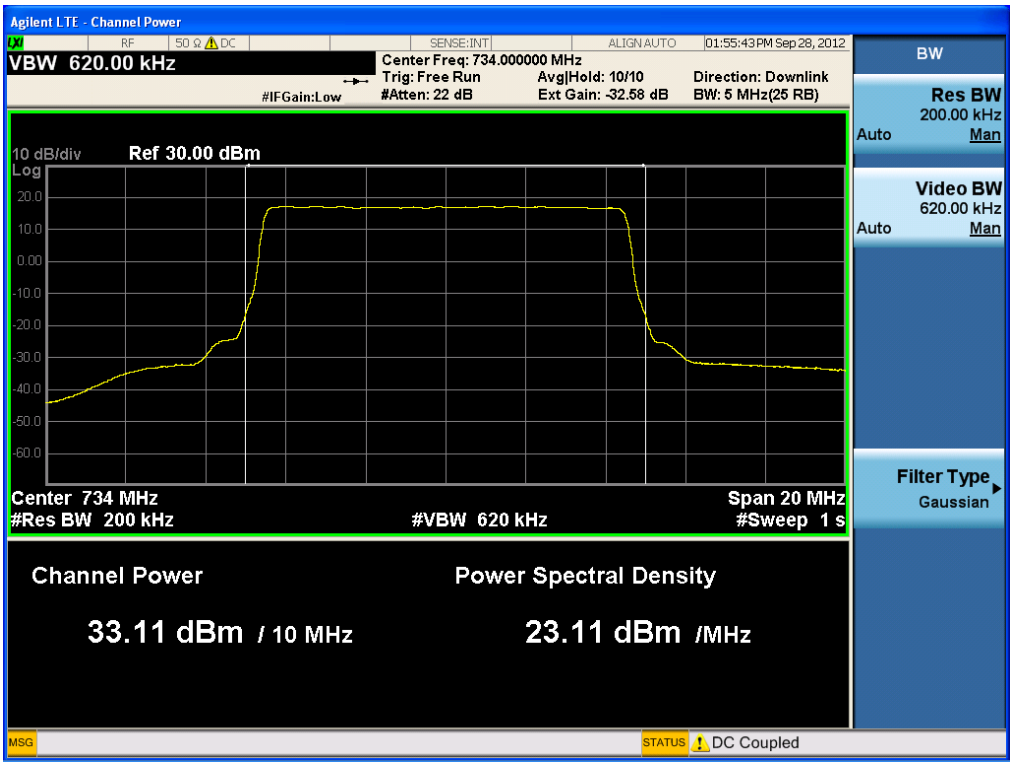
[LTE Downlink A]



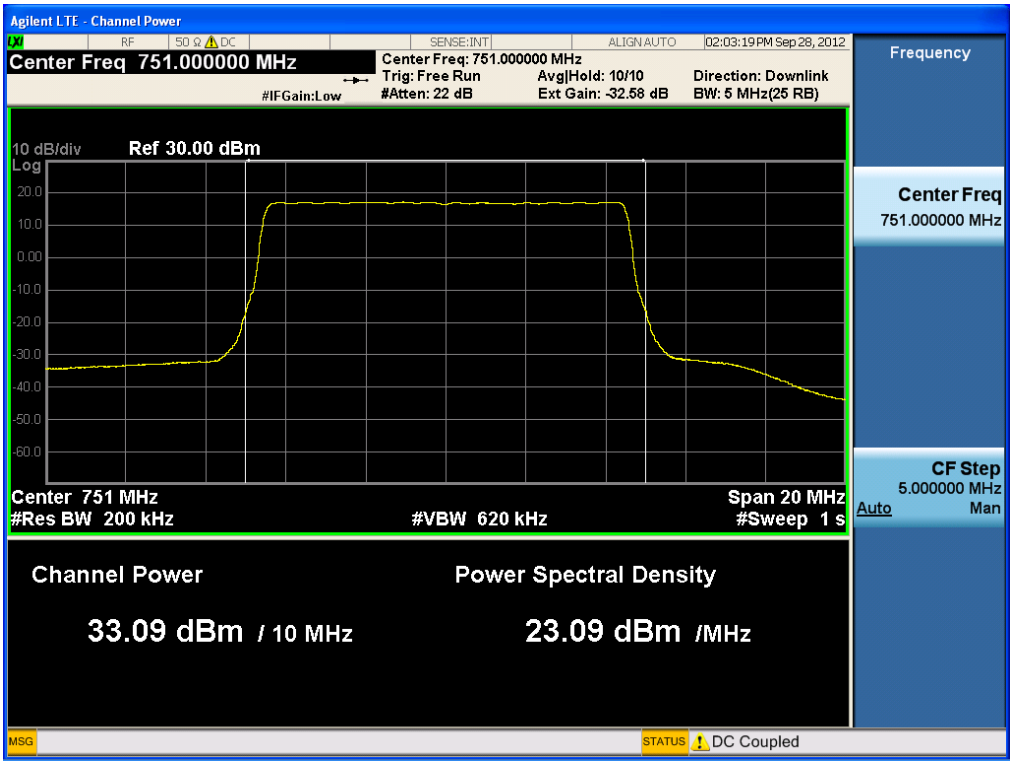
[LTE Downlink B]



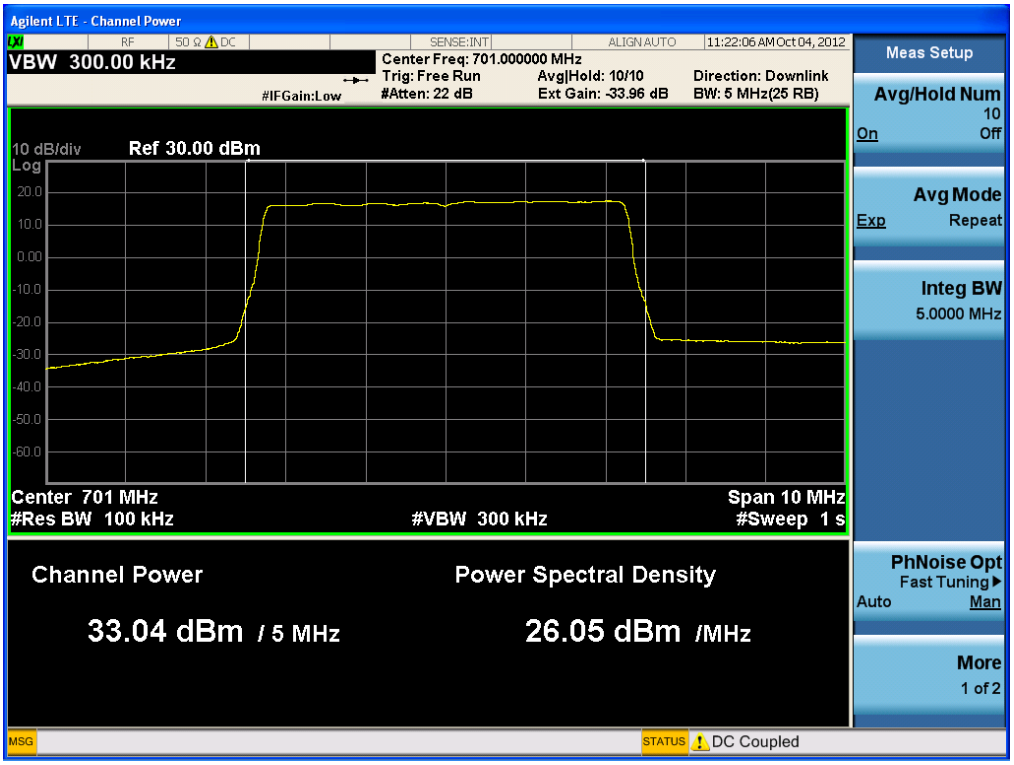
[LTE Downlink A+B]



[LTE Downlink C]



[LTE Uplink A]



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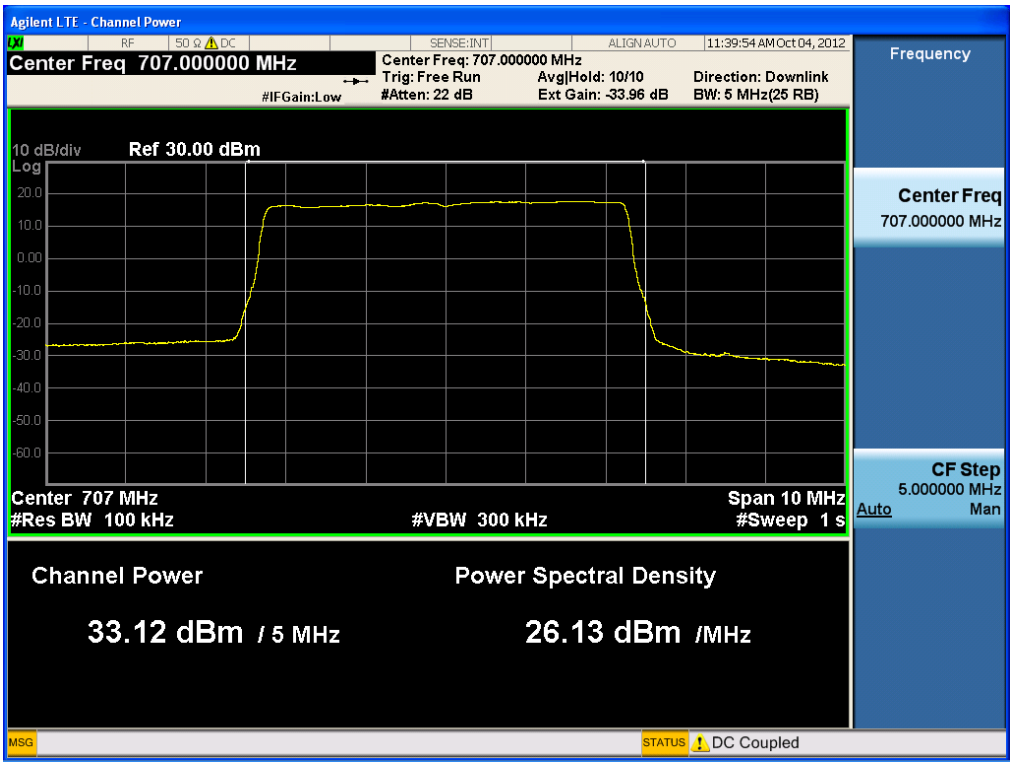
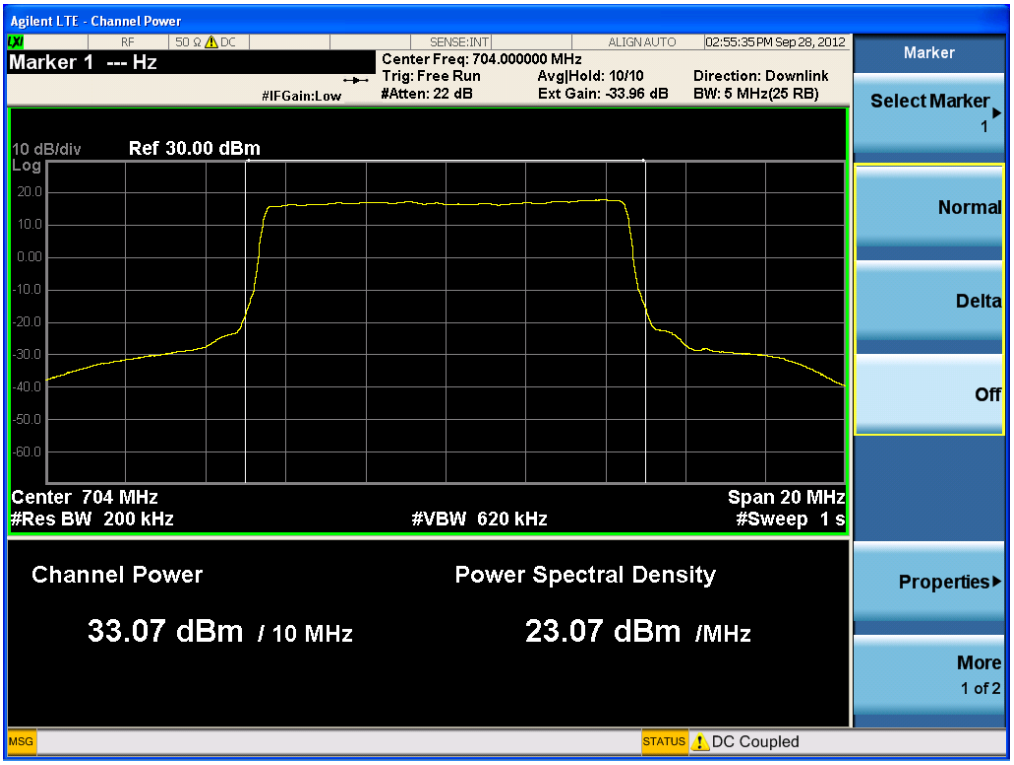
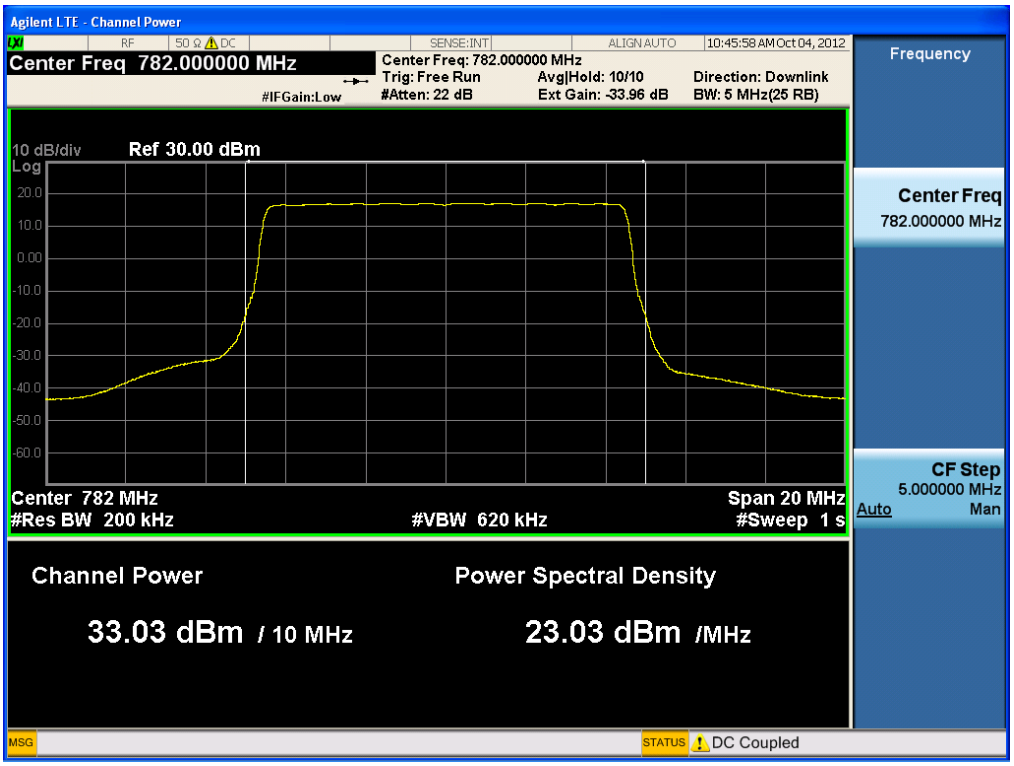


[LTE Uplink A+B]



[LTE Uplink C]



6. OCCUPIED BANDWIDTH

Test Requirement(s): § 2.1049 Measurements required: Occupied bandwidth:

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of § 2.1049 (a) through (i) as applicable.

Test Requirements: RSS-131 6.1

The passband gain shall not exceed the nominal gain by more than 1.0 dB. The 20 dB bandwidth shall not exceed the nominal bandwidth that is stated by the manufacturer. Outside of the 20 dB bandwidth, the gain shall not exceed the gain at the 20 dB point.

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made with a Spectrum Analyzer connected to the RF ports for both Uplink and Downlink
The modulation characteristics of signal generator's carrier was measured first at a maximum RF level prescribed by the OEM. The signal generator was then connected to either the Uplink or Downlink input at the appropriate RF level. The resulting modulated signal through the EUT was measured and compared against the original signal.

Test Procedures: RSS-131 4.2

Adjust the internal gain control of the equipment under test to the nominal gain for which equipment certification is sought.
With the aid of a signal generator and spectrum analyser, measure the 20 dB bandwidth of the amplifier (i.e. at the point where the gain has fallen by 20 dB). Measure the gain-versus-frequency response of the amplifier from the midband frequency f0 of the passband up to at least f0 + 250% of the 20 dB bandwidth.

Test Results: The EUT complies with the requirements of this section.

Input Signal	Modulation	Level (dBm)
LTE	64QAM	-56.2

[Downlink]

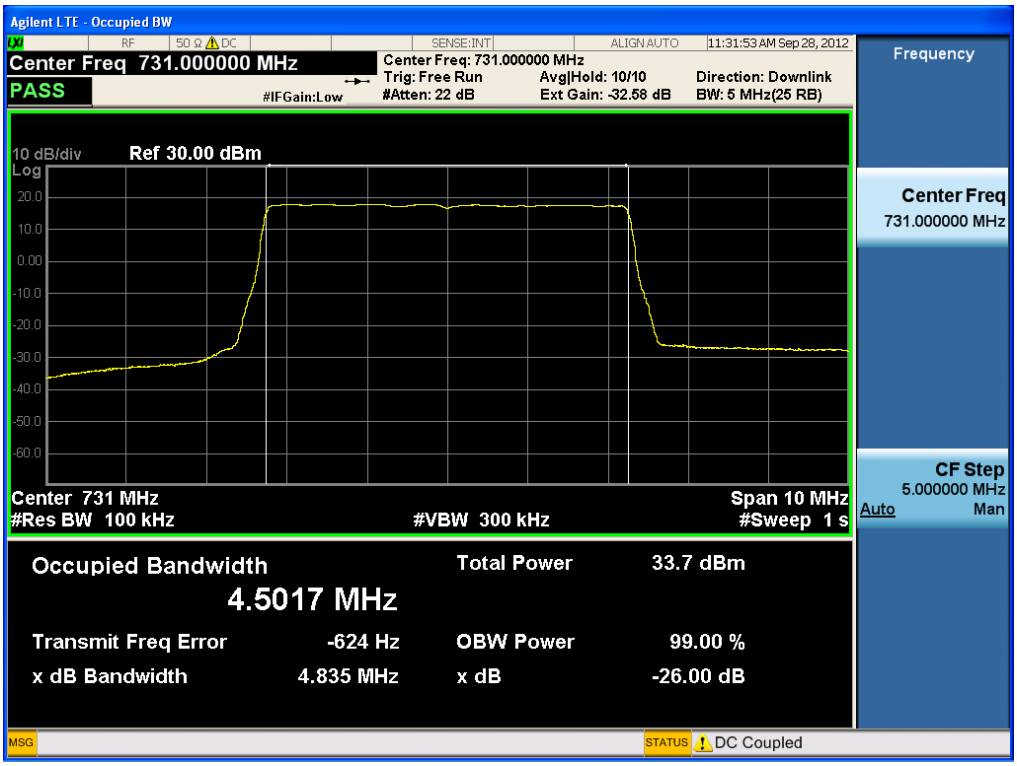
Band	Bandwidth	Frequency MHz	Occupied Bandwidth (Output) MHz	Occupied Bandwidth (Input) MHz
A	5 MHz	731	4.5017	4.5655
B		737	4.4973	4.5643
A&B	10 MHz	734	8.9746	8.9889
C		751	8.9791	8.9893

[Uplink]

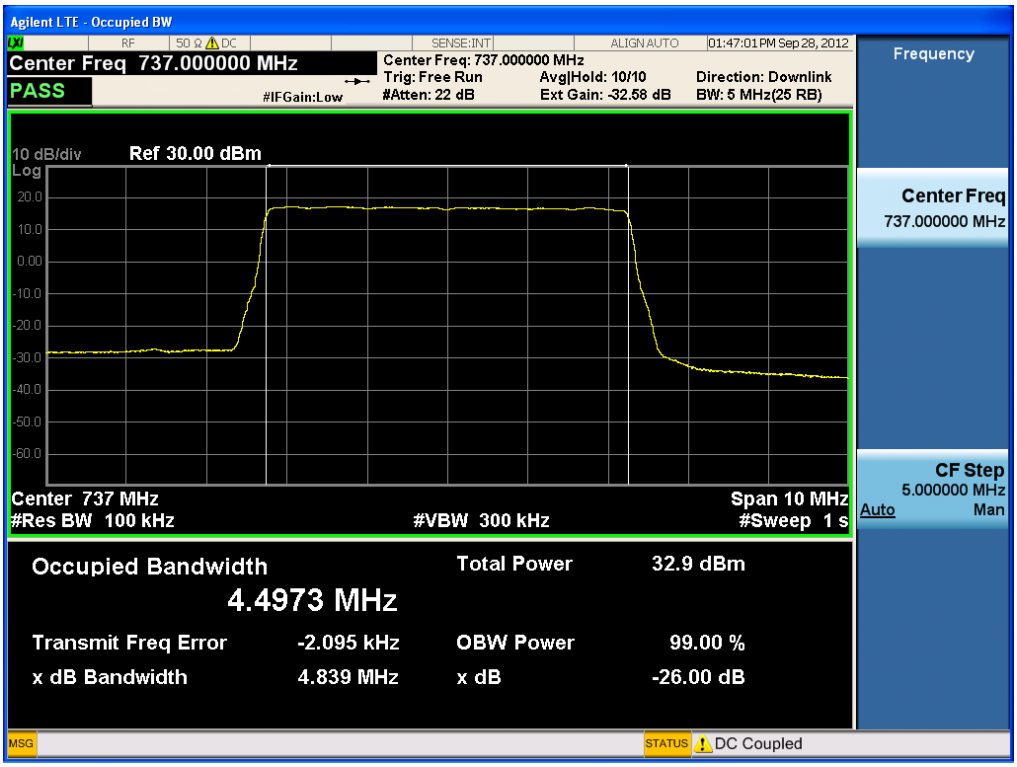
Band	Bandwidth	Frequency MHz	Occupied Bandwidth (Output) MHz	Occupied Bandwidth (Input) MHz
A	5 MHz	701	4.4977	4.5723
B		707	4.4993	4.5636
A&B	10 MHz	704	8.9882	8.9894
C		782	8.9640	8.9899

Plots of Occupied Bandwidth

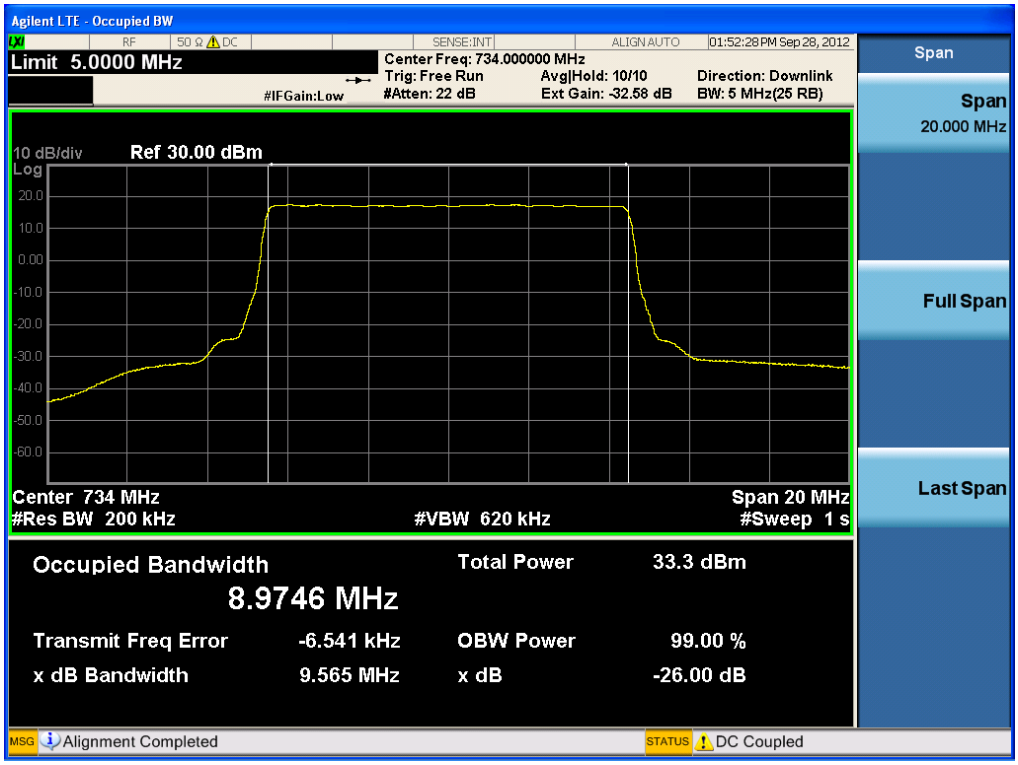
[Output LTE Downlink A]



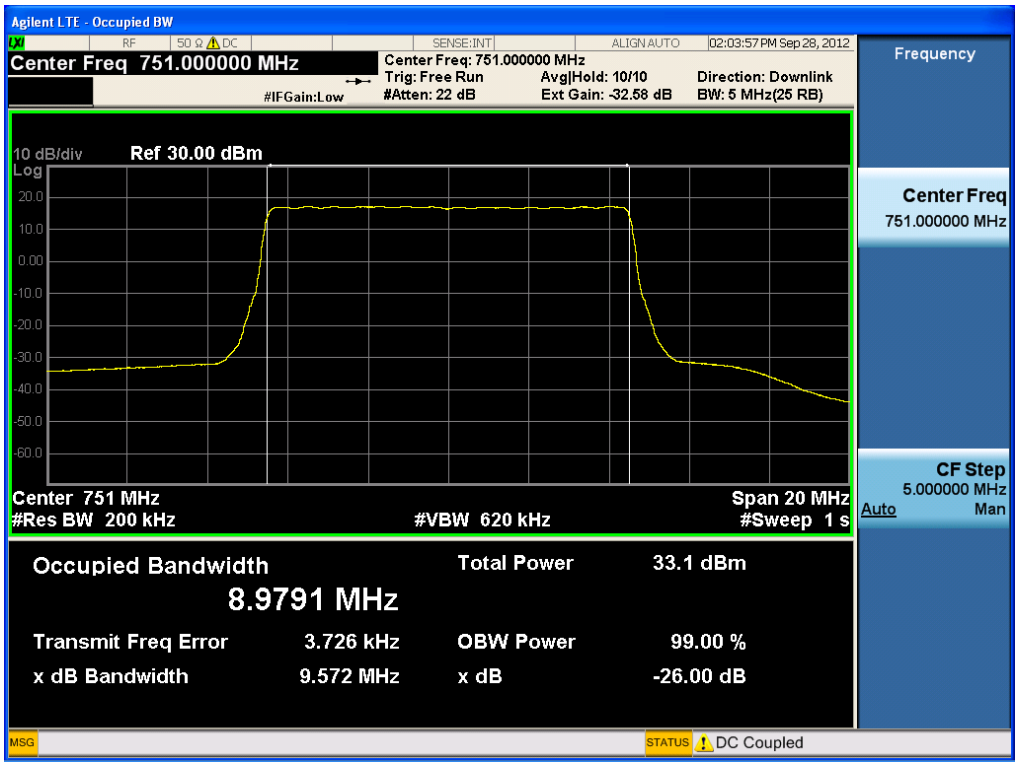
[Output LTE Downlink B]



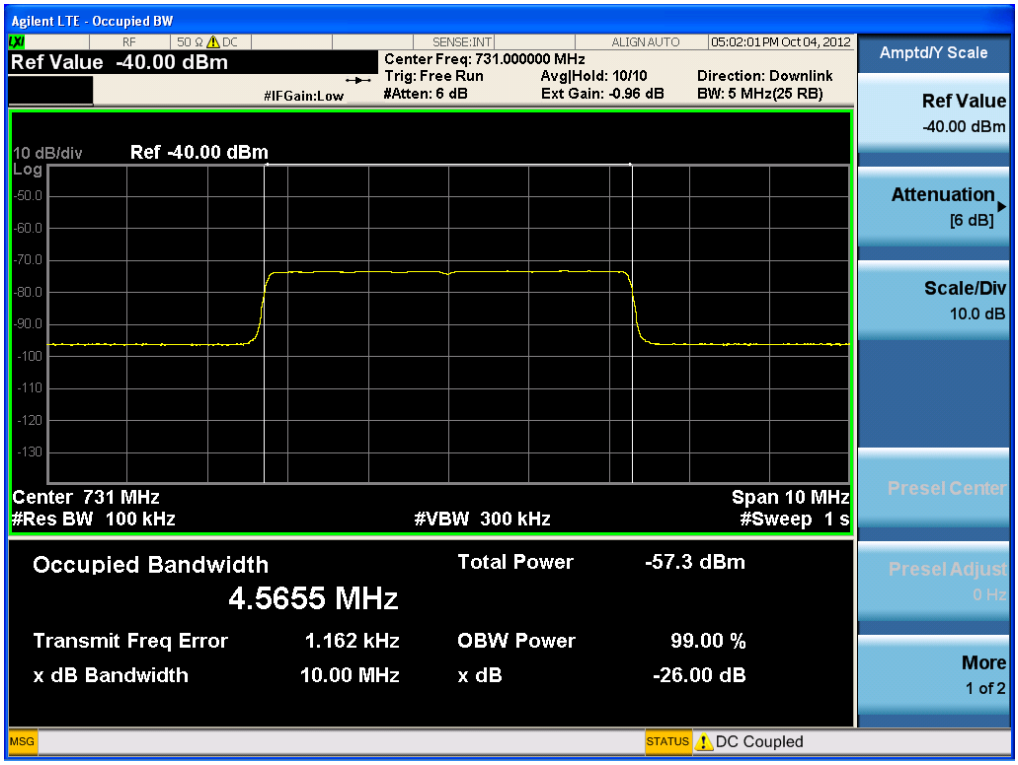
[Output LTE Downlink A+B]



[Output LTE Downlink C]



[Input LTE Downlink A]



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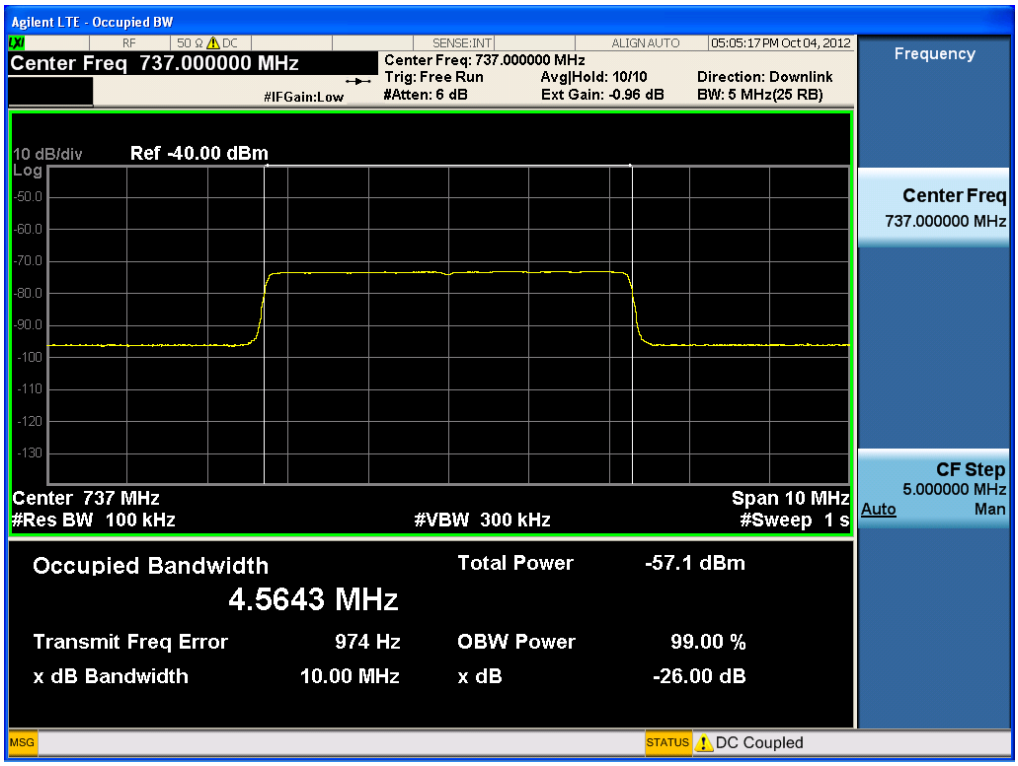
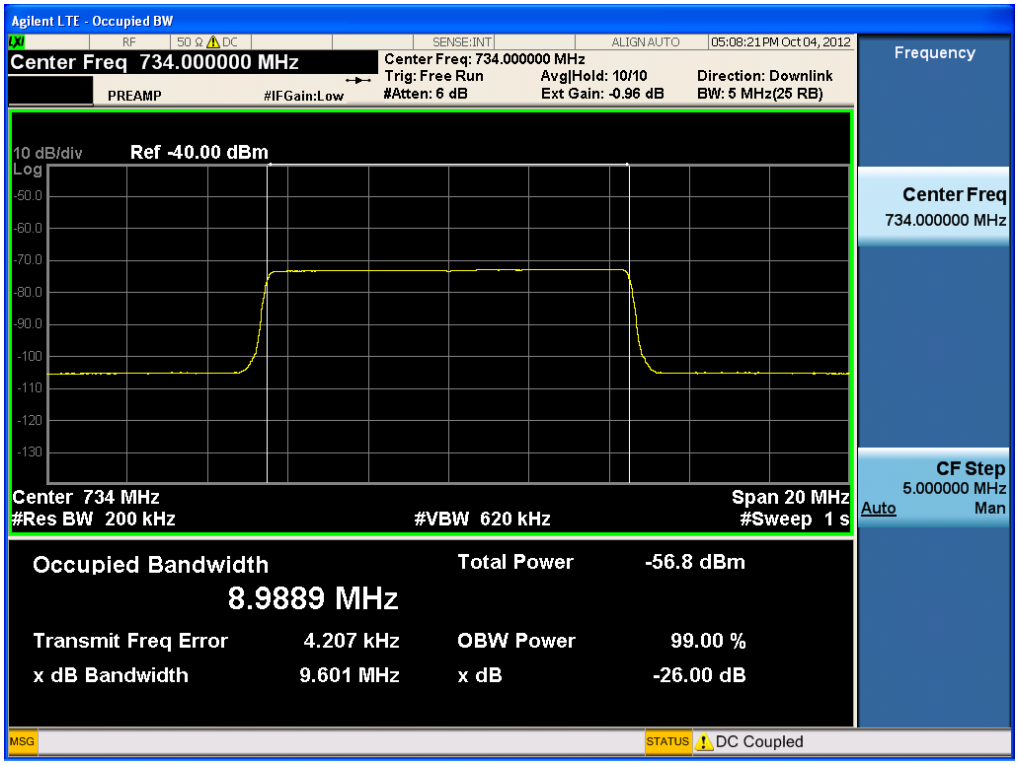


[Input LTE Downlink A+B]



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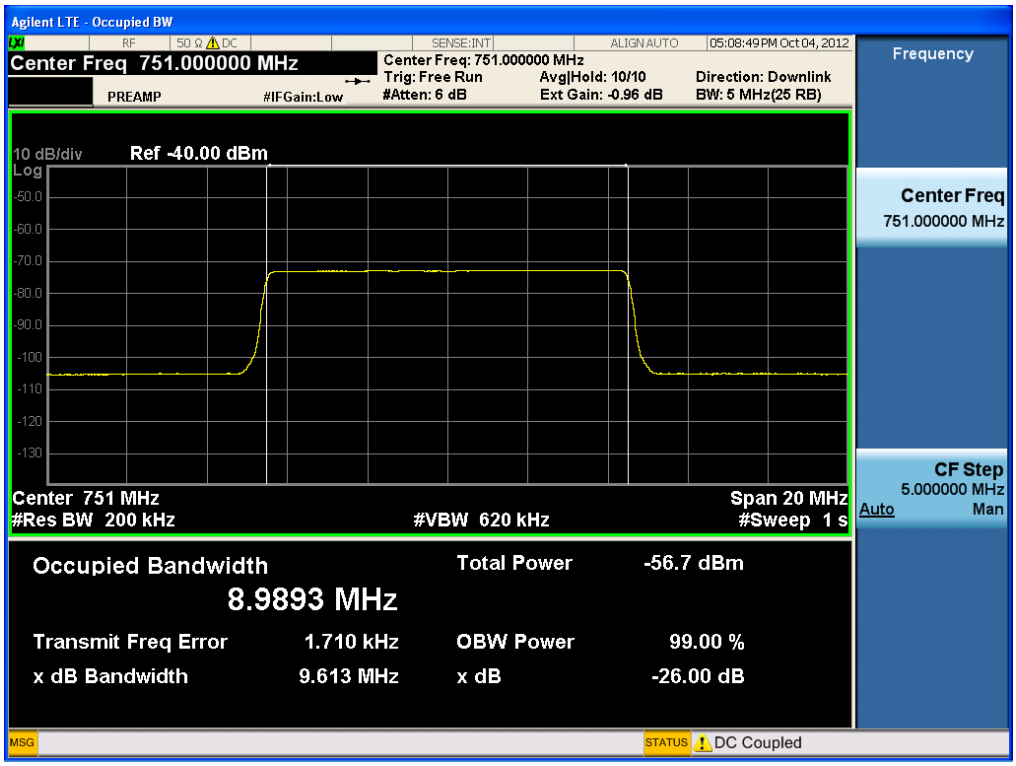
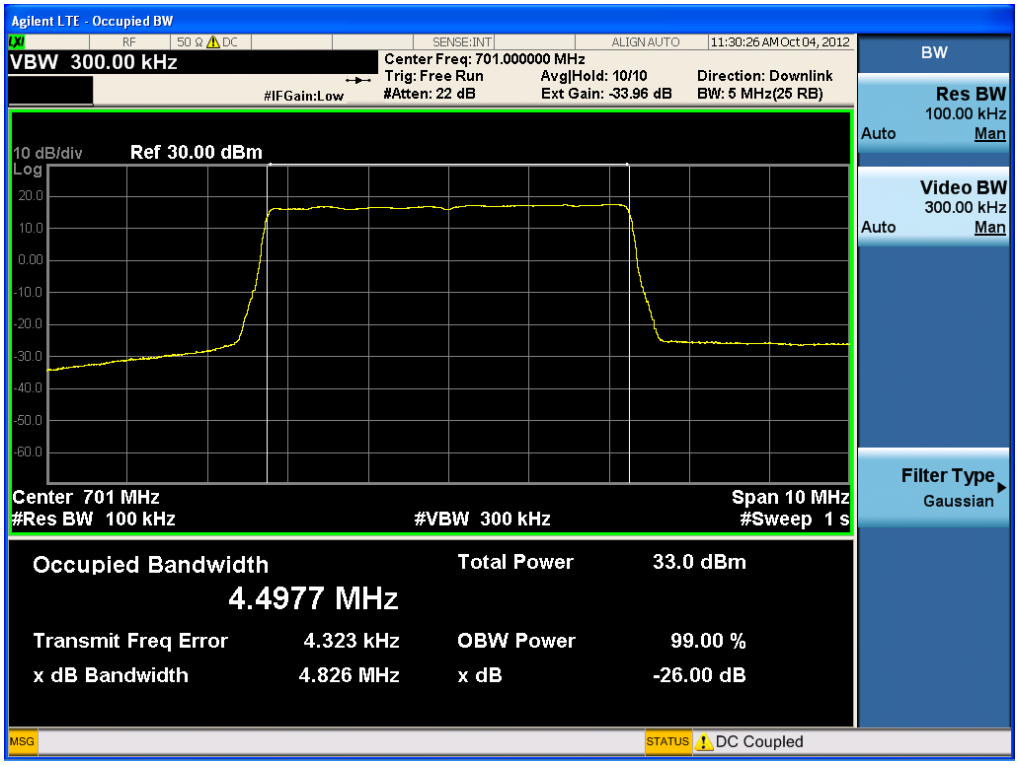


[Output LTE Uplink A]



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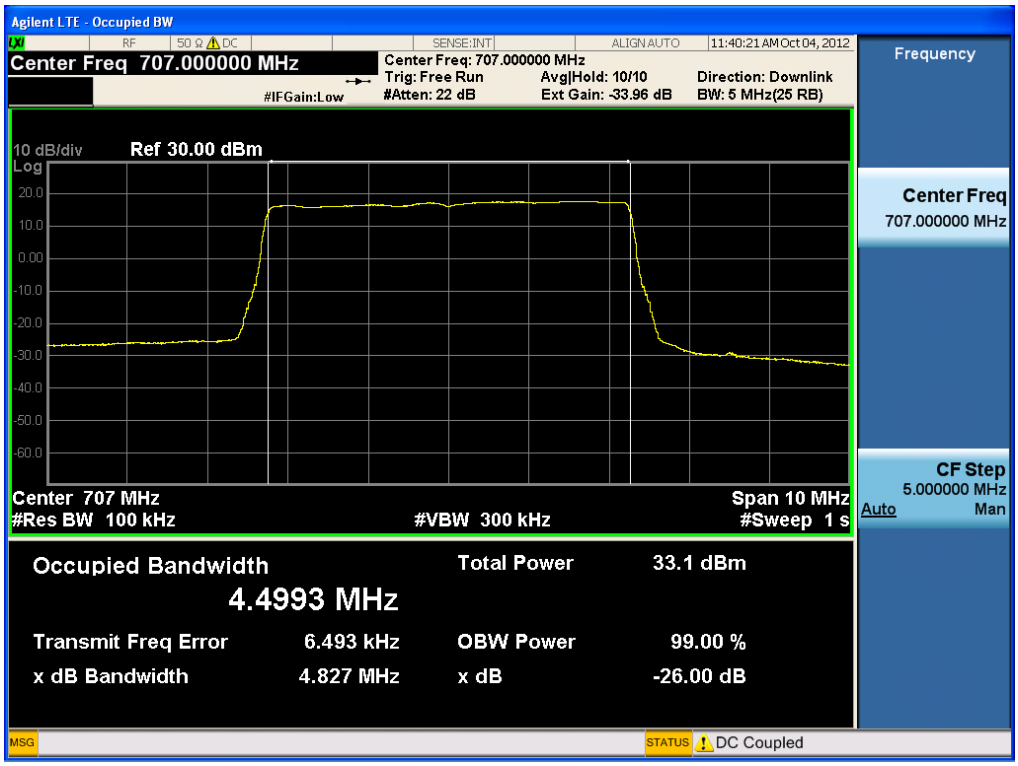
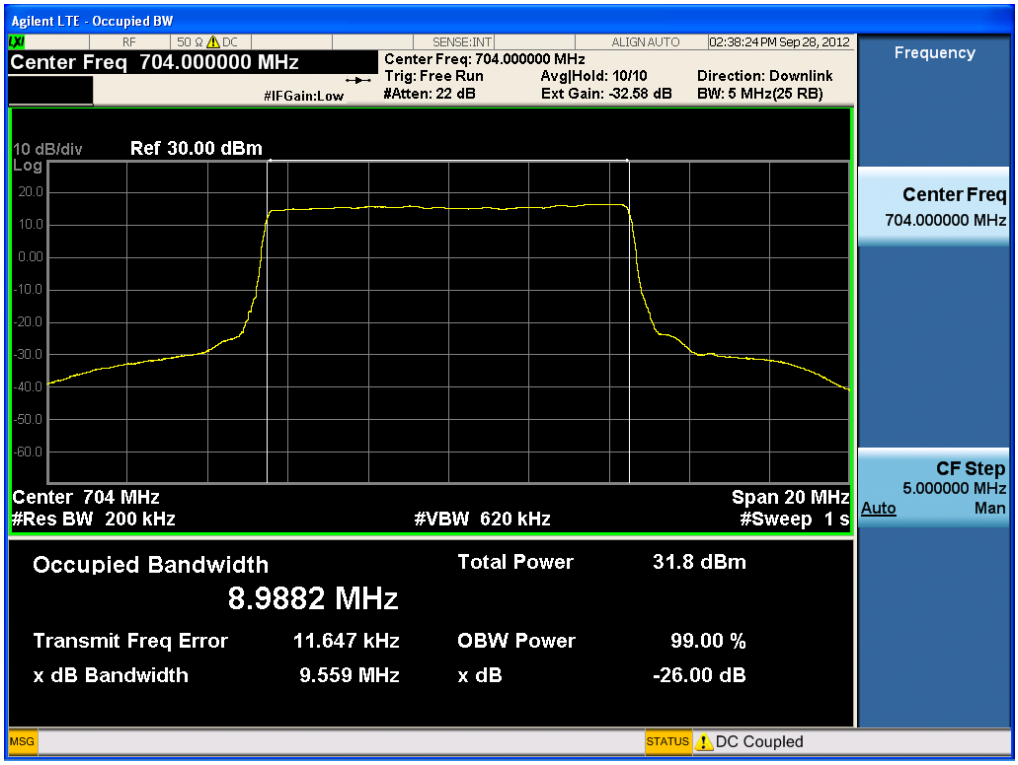
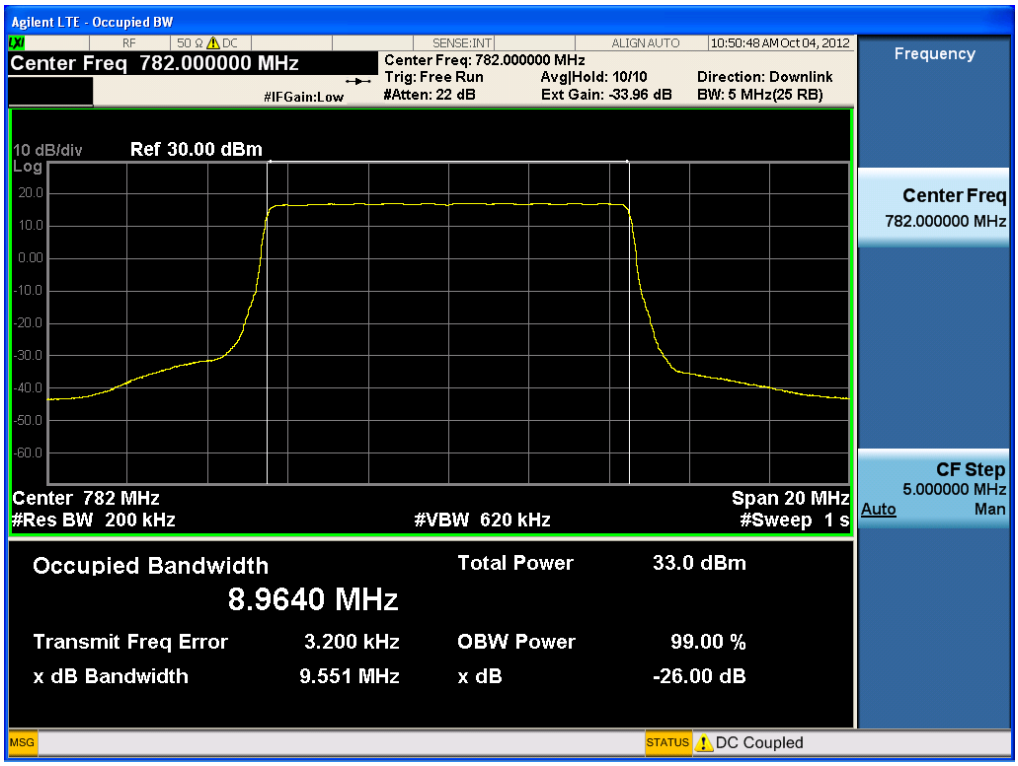


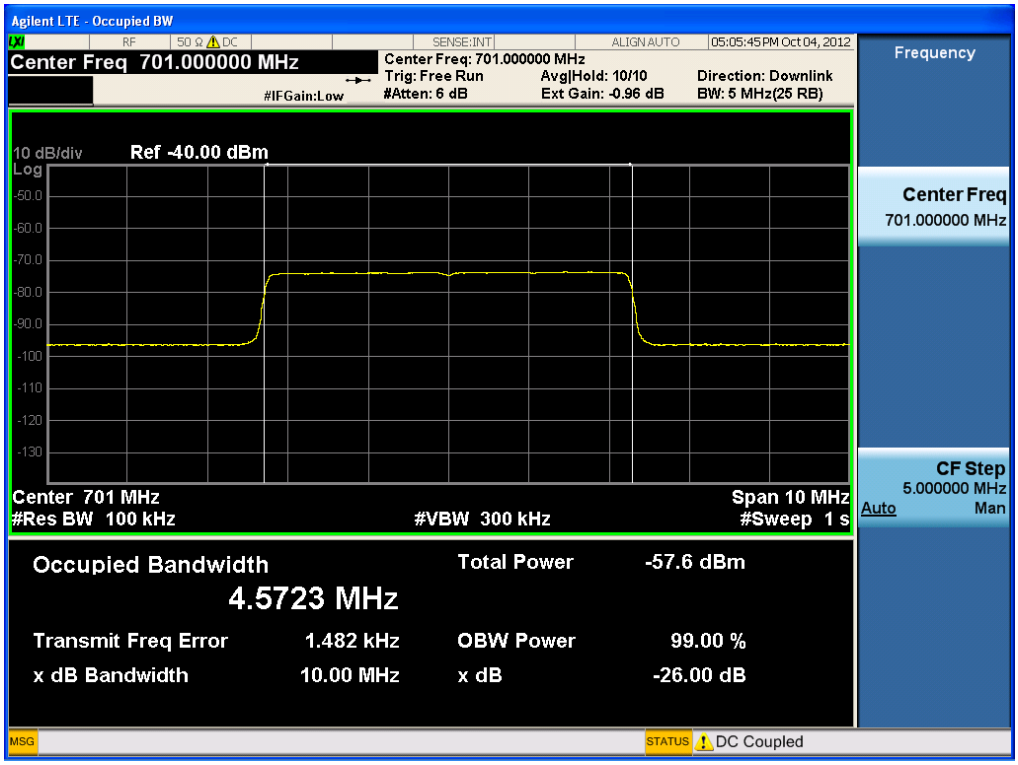
[Output LTE Uplink A+B]



[Output LTE Uplink C]



[Input LTE Uplink A]



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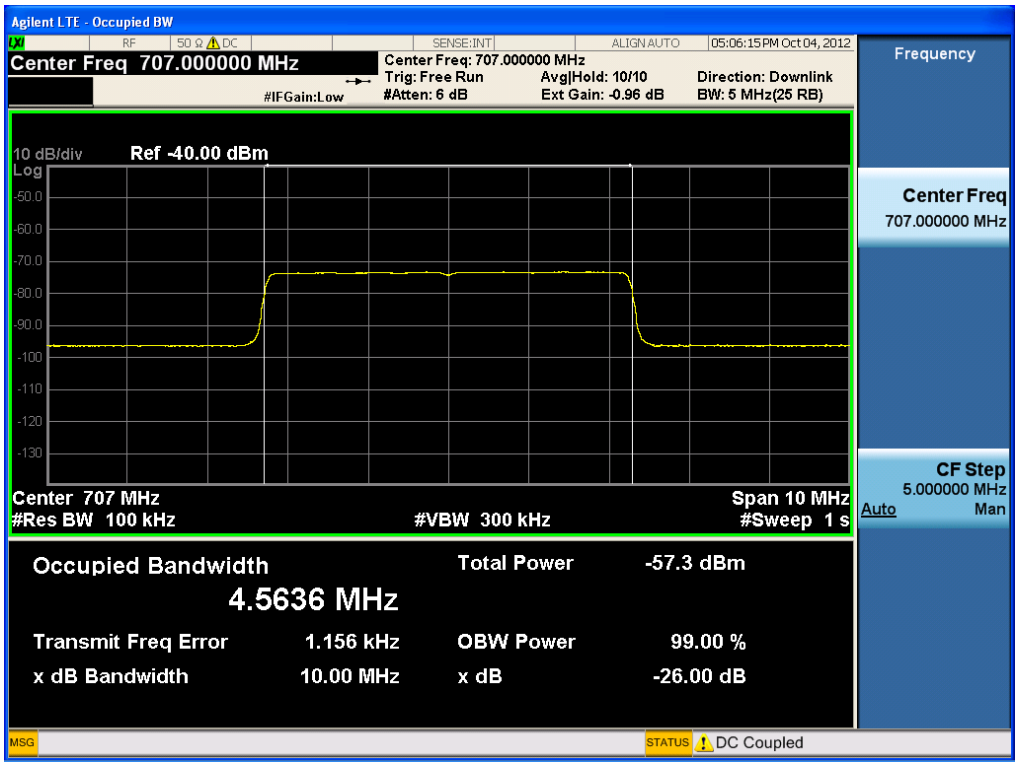
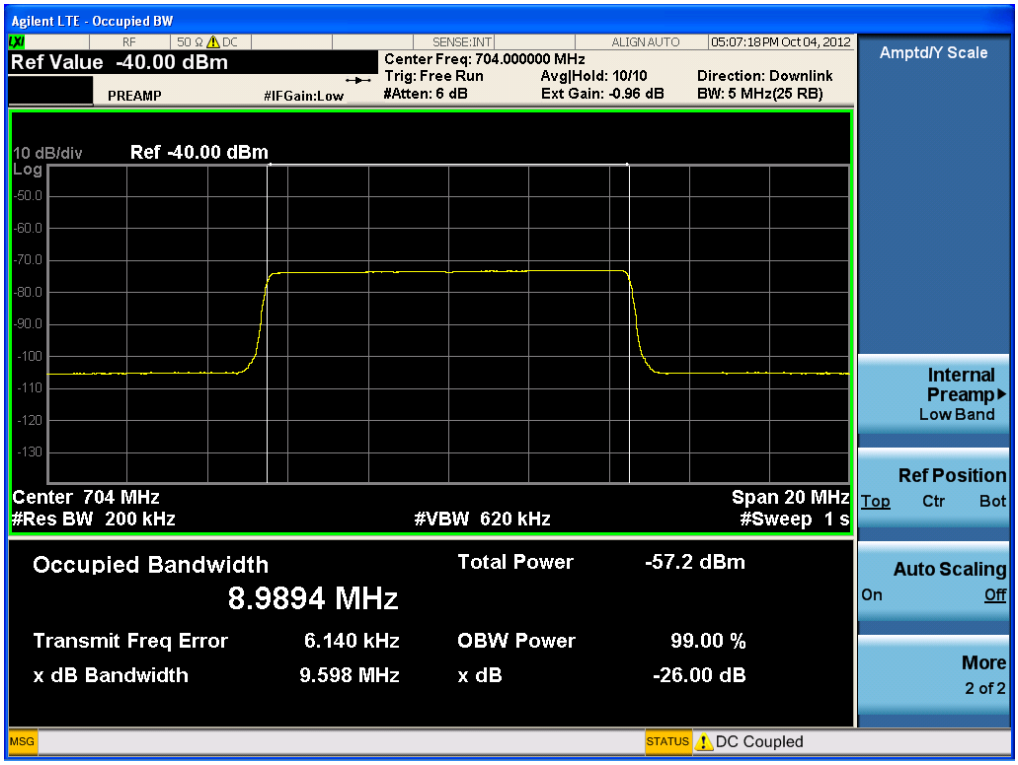
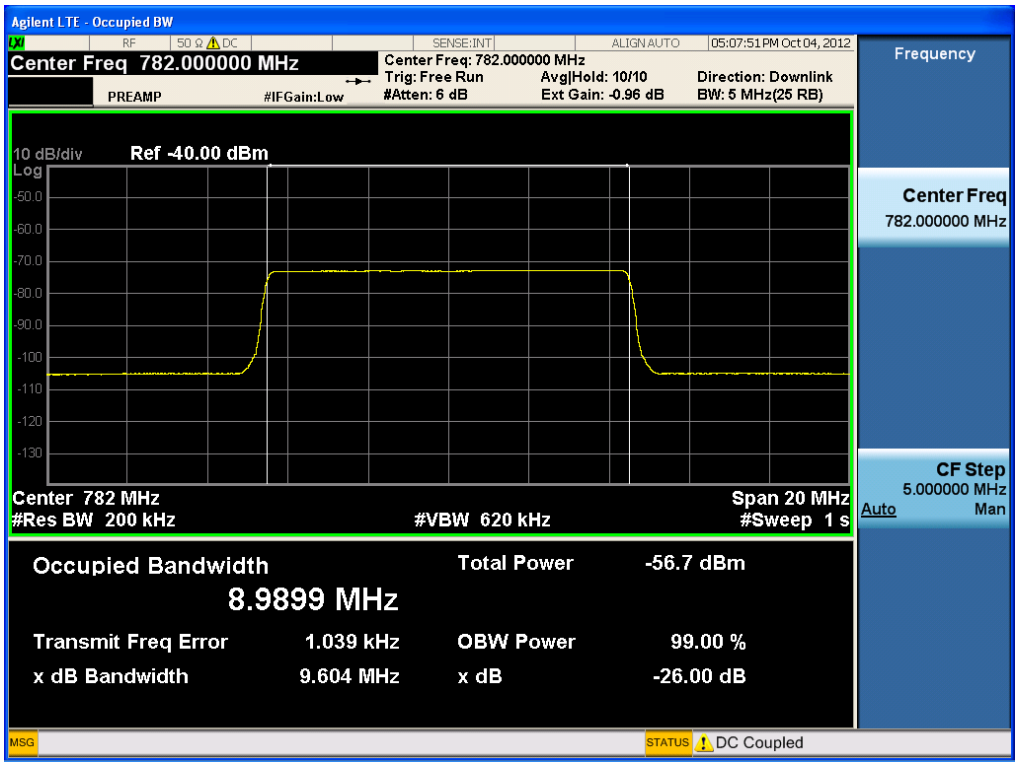


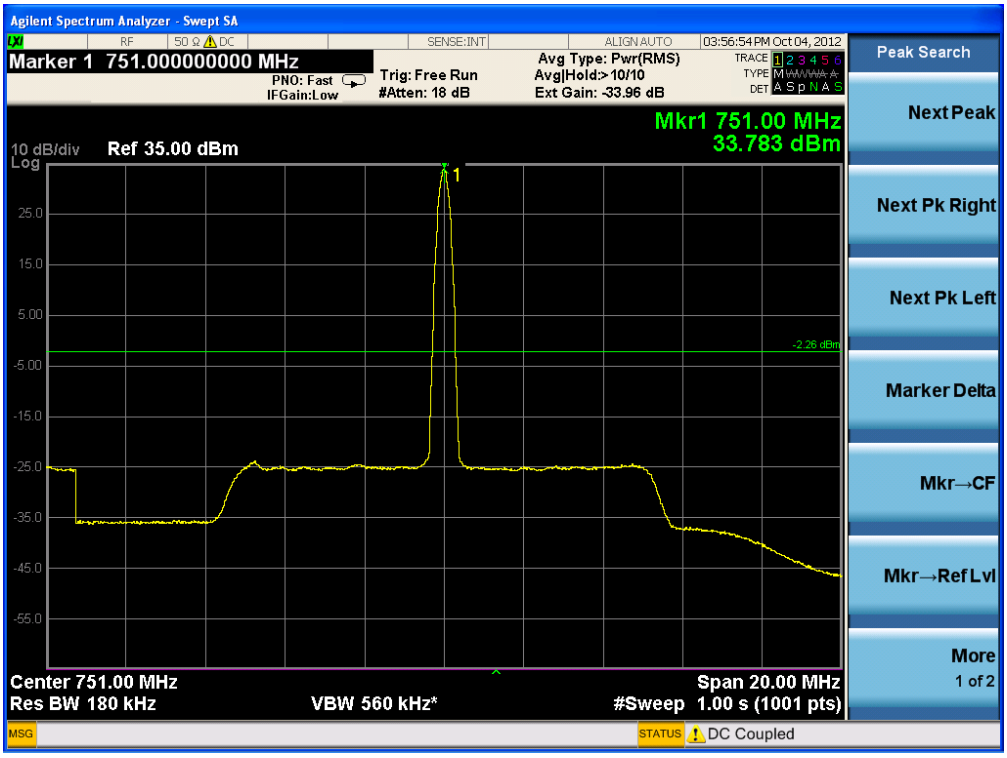
[Input LTE Uplink A+B]



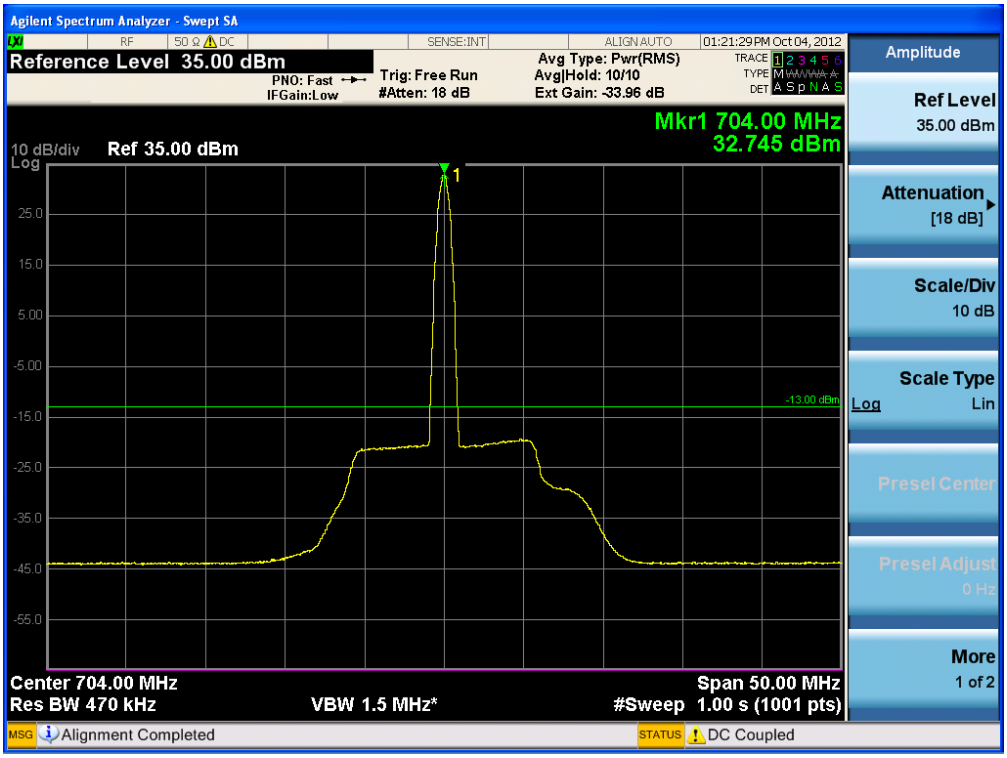
[Input LTE Uplink C]

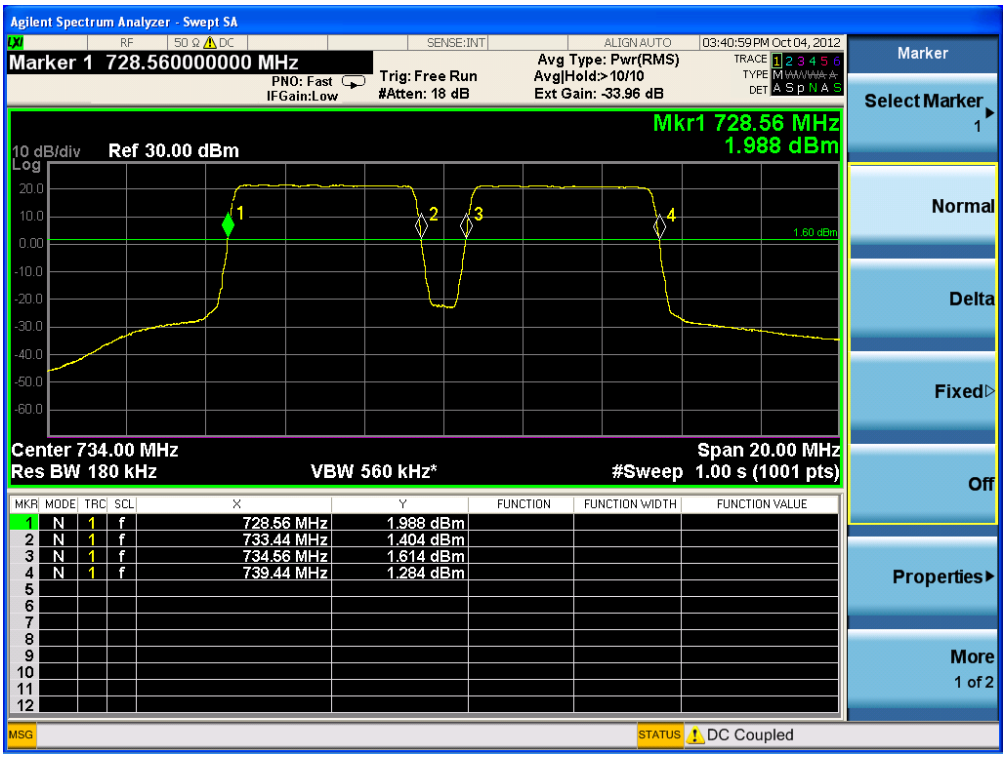


Downlink Passband Gain : 33.783- (-56.2) = 89.983 dB < nominal gain 90 dB

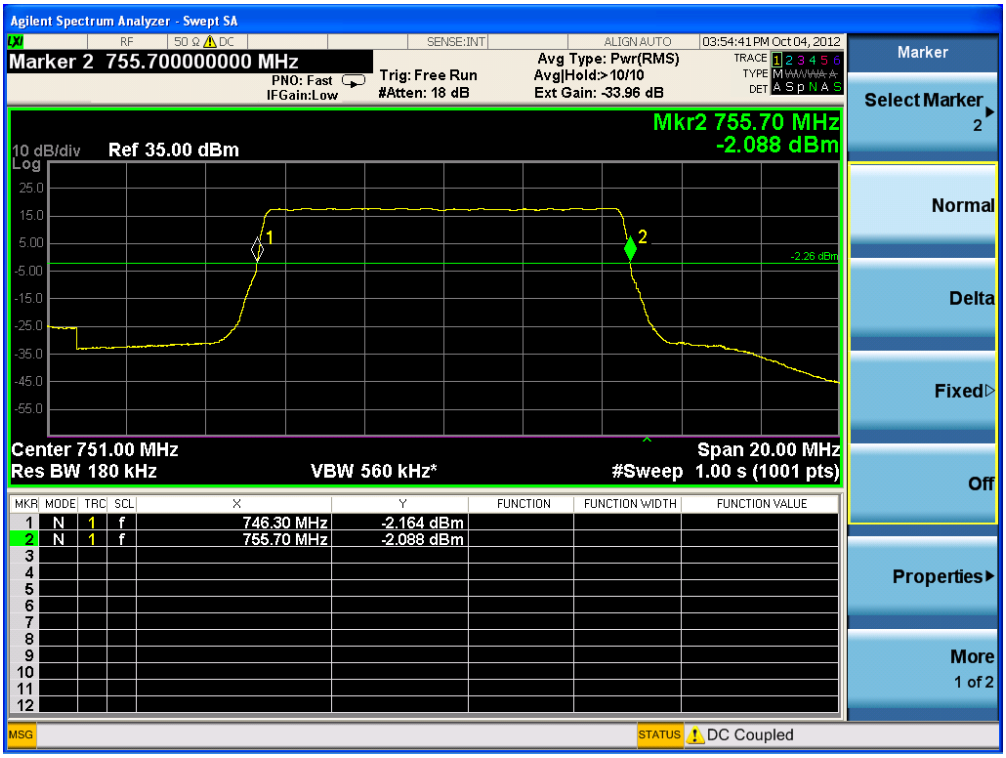


- **Uplink Passband Gain : 32.745- (-56.2) = 88.945 dB < nominal gain 90 dB**

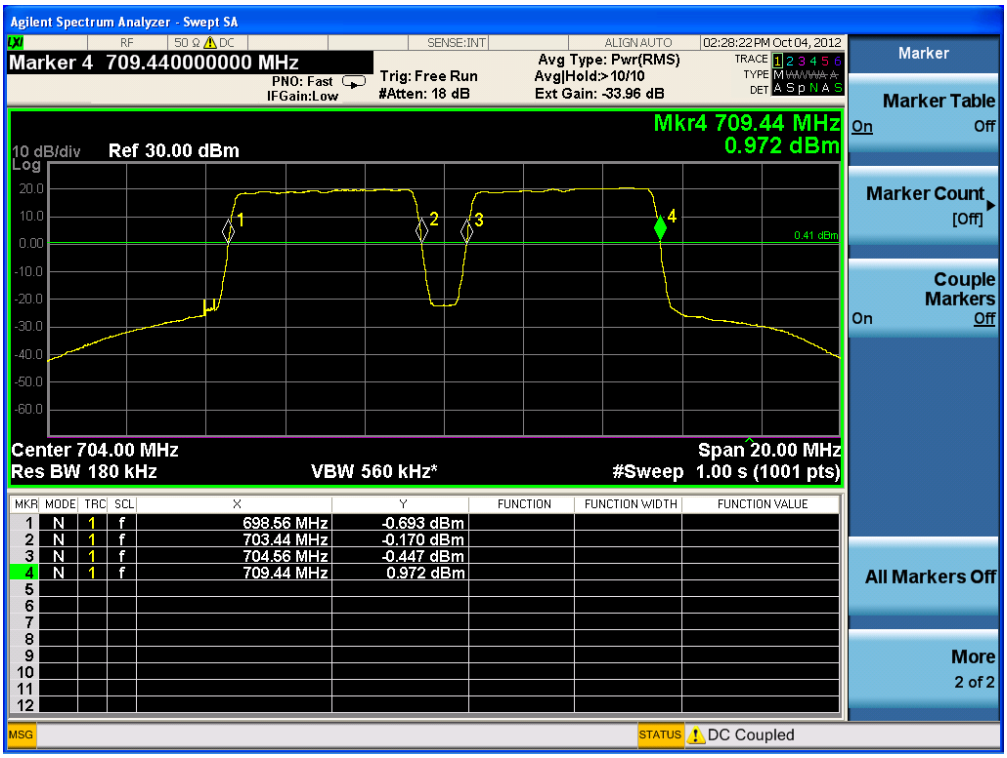




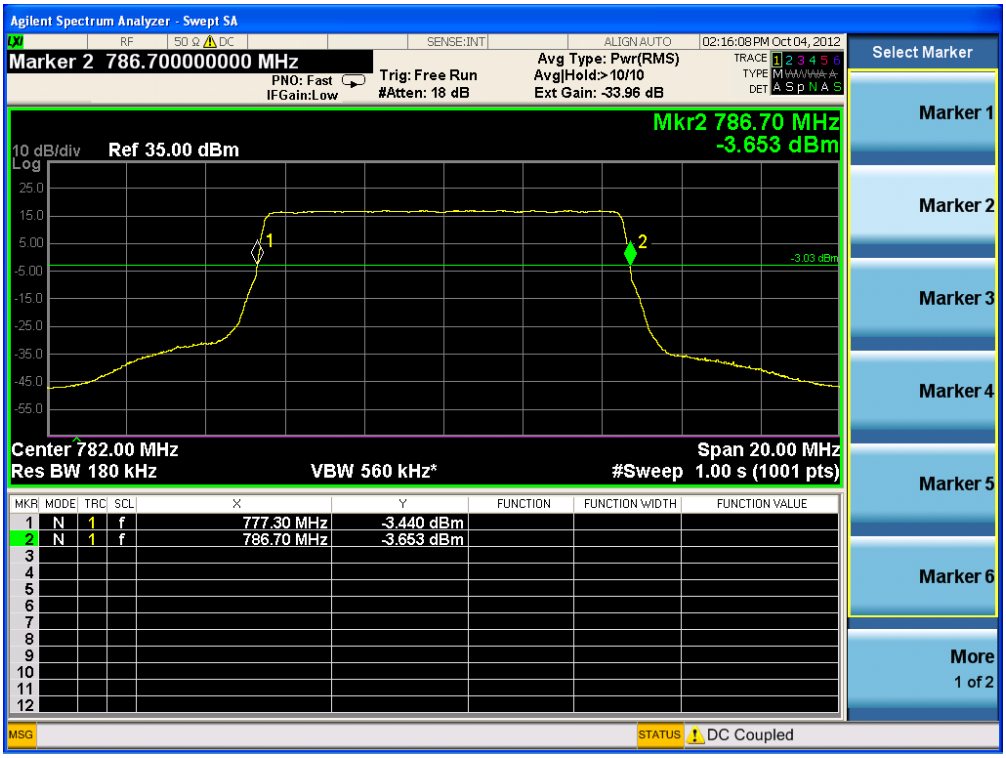
- **Downlink A+B Band 20 dB Bandwidth : 728.56 – 739.44 = 10.88 MHz < Nominal Bandwidth 12 MHz**



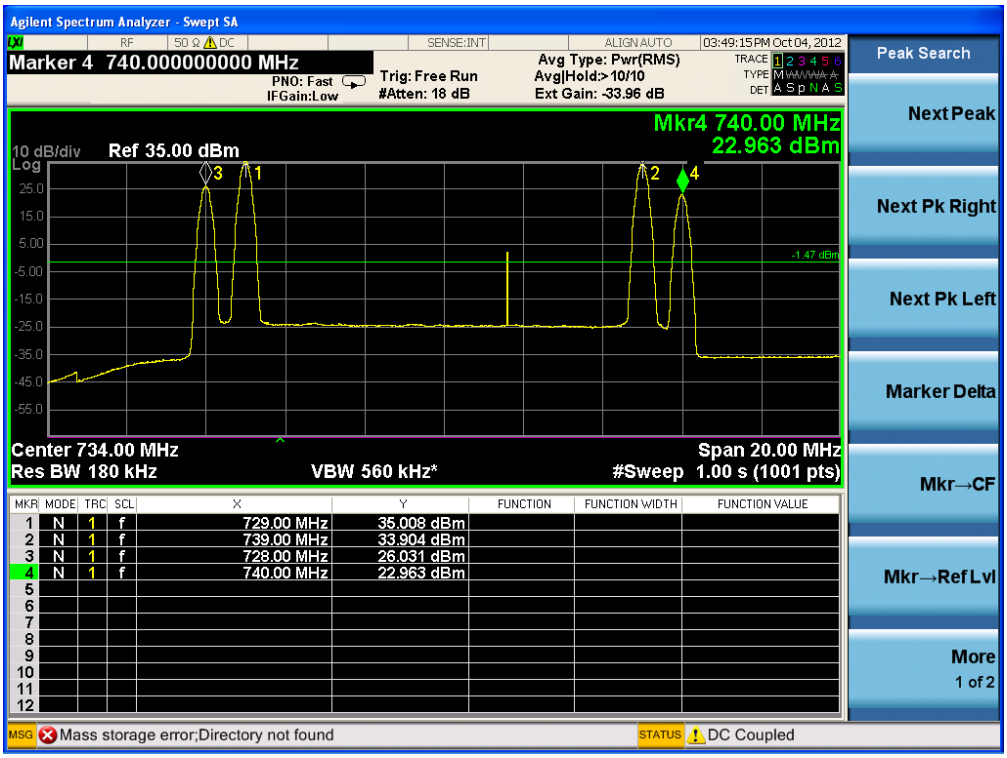
- **Downlink C Band 20 dB Bandwidth : 755.70 – 746.30 = 9.4 MHz < Nominal Bandwidth 11 MHz**



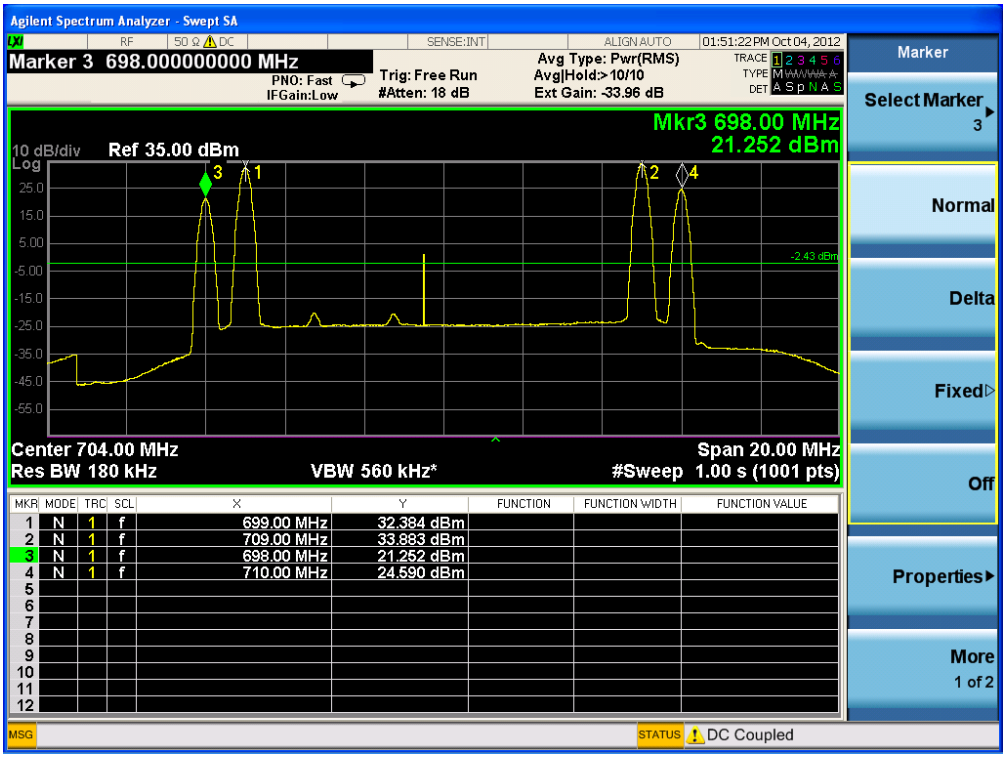
- **Uplink A+B Band 20 dB Bandwidth : 709.44 – 698.56 = 10.88 MHz < Nominal Bandwidth 12 MHz**



- **Uplink C Band 20 dB Bandwidth : 786.70 – 777.30 = 9.4 MHz < Nominal Bandwidth 11 MHz**



- **Out of 20 dB Bandwidth Gain is less than 20 dB Bandwidth Gain by 8.977 dB**



- **Out of 20 dB Bandwidth Gain is less than 20 dB Bandwidth Gain by 9.293 dB**

7. SPURIOUS AND HARMONIC EMISSION AT ANTENNA TERMINAL

Test Requirement(s): § 2.1051 Measurements required: Spurious emissions at antenna terminals:

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§ 27.53 Emission limits

(c) For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

Test Requirement(s): RSS-131 6.4

Spurious emissions of zone enhancers and translators shall be suppressed as much as possible.

Spurious emissions shall be attenuated below the rated power of the enhancer by at least: 43 + 10 Log10(Prated in watts), or 70 dB, whichever is less stringent.

Note: If the minimum standard is not met, check to see if the input signal generators have a high harmonic content.

Test Procedures: A modulated carrier generated by the signal generator carrier was connected to either the Uplink or Downlink RF port at a maximum level as determined by the spectrum analyzer was connected to either the Uplink or Downlink port depending on the circuitry being measured.

The spectrum was investigated from 30 MHz to the 26.5 GHz of the carrier.

Test Procedures: RSS-131 4.4

The spurious emissions of the equipment under test shall be measured using the two-tone method in section 4.3.1, with the two tones Po1 and Po2 set to the required levels. Using a spectrum analyser with a resolution bandwidth set at 100 kHz, search for spurious emissions from 30 MHz to at least 5 times the highest RF passband frequency. The search may omit the band that contains the test tones and intermodulation products.

Test Results: The EUT complies with the requirements of this section. There were no detectable Spurious emissions for this EUT.

Sample Calculation

Output Power = Reading Value + ATT loss + Cable loss

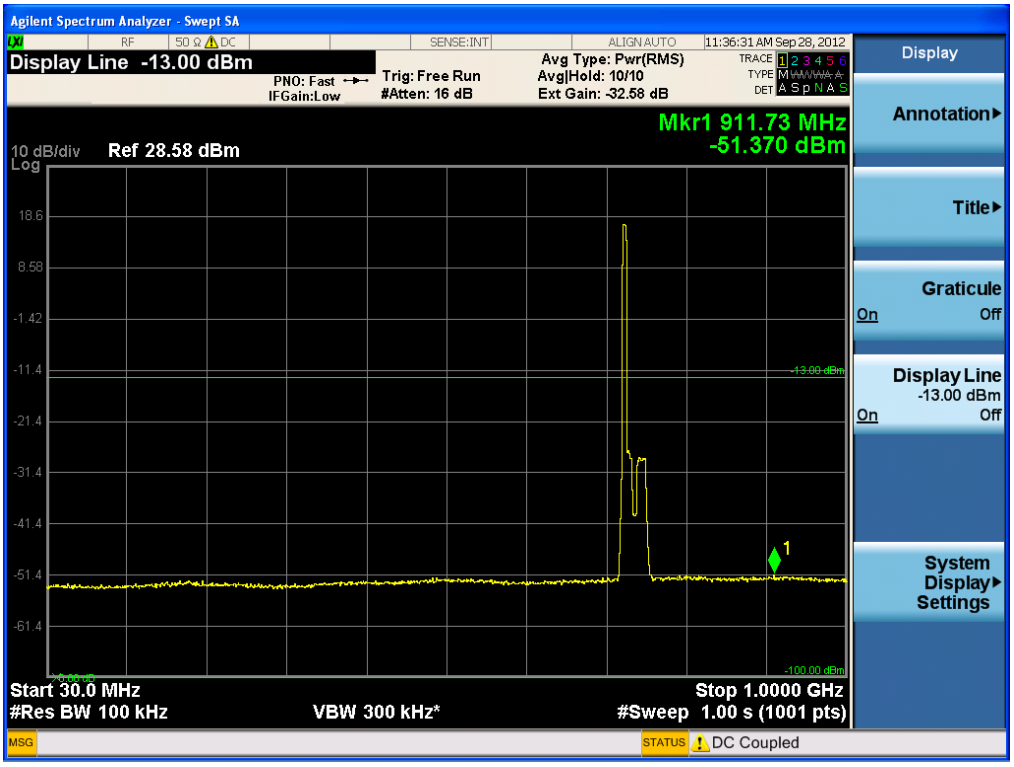
1. Spectrum reading values are not plot data. The power results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss (32.58 dB at downlink, and 33.96 dB at uplink)
3. Actual value of loss for the attenuator and cable combination is 32.58 dB at 737 MHz , 33.96 dB at 782 MHz.

※ The Test Report's Intermodulation test result was executed at Maximum gain setting mode because it is a little worst case for the EUT.

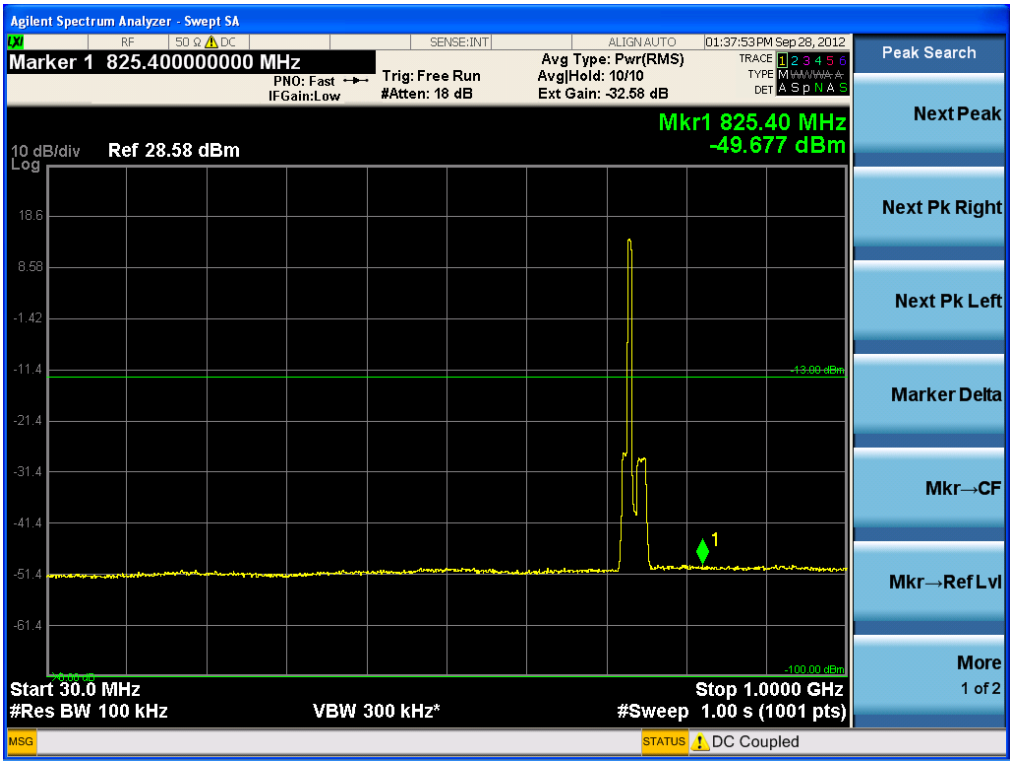
Plots of Spurious Emission

Conducted Spurious Emissions (30 MHz – 1 GHz)

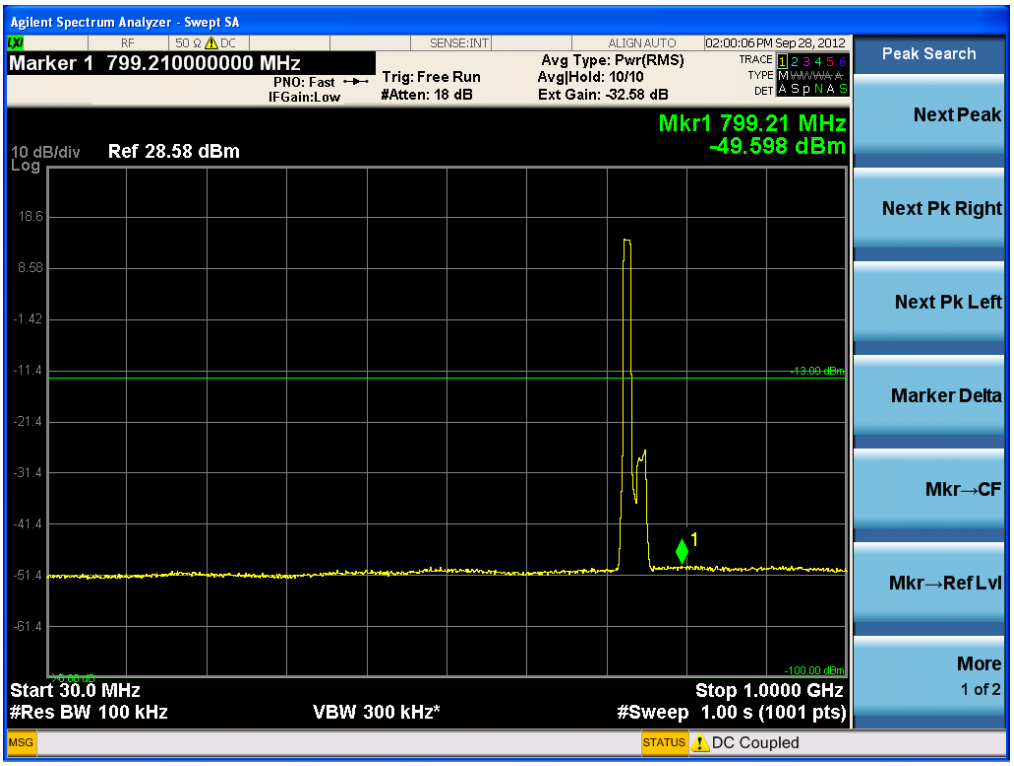
[LTE Downlink A]



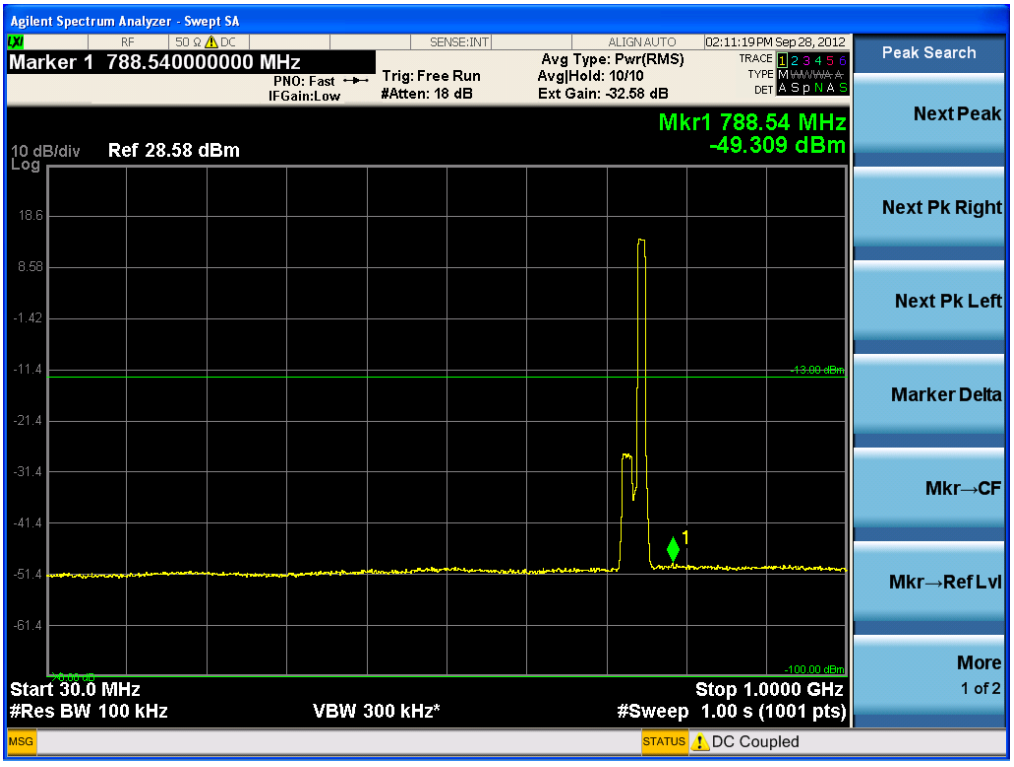
[LTE Downlink B]



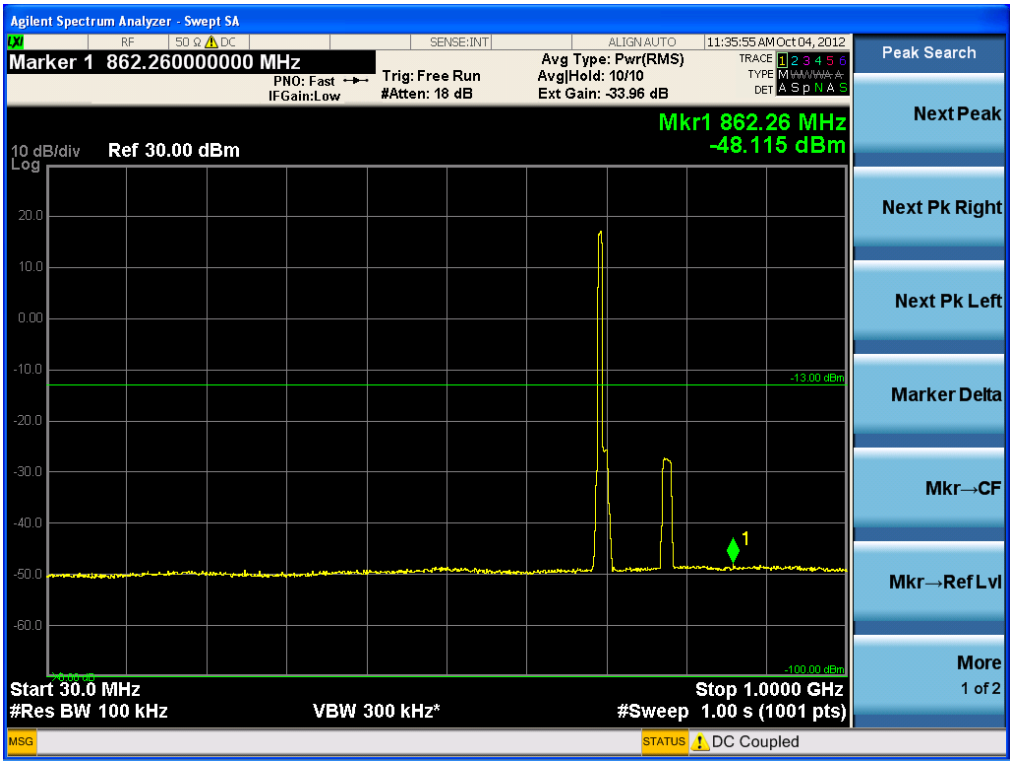
[LTE Downlink A+B]



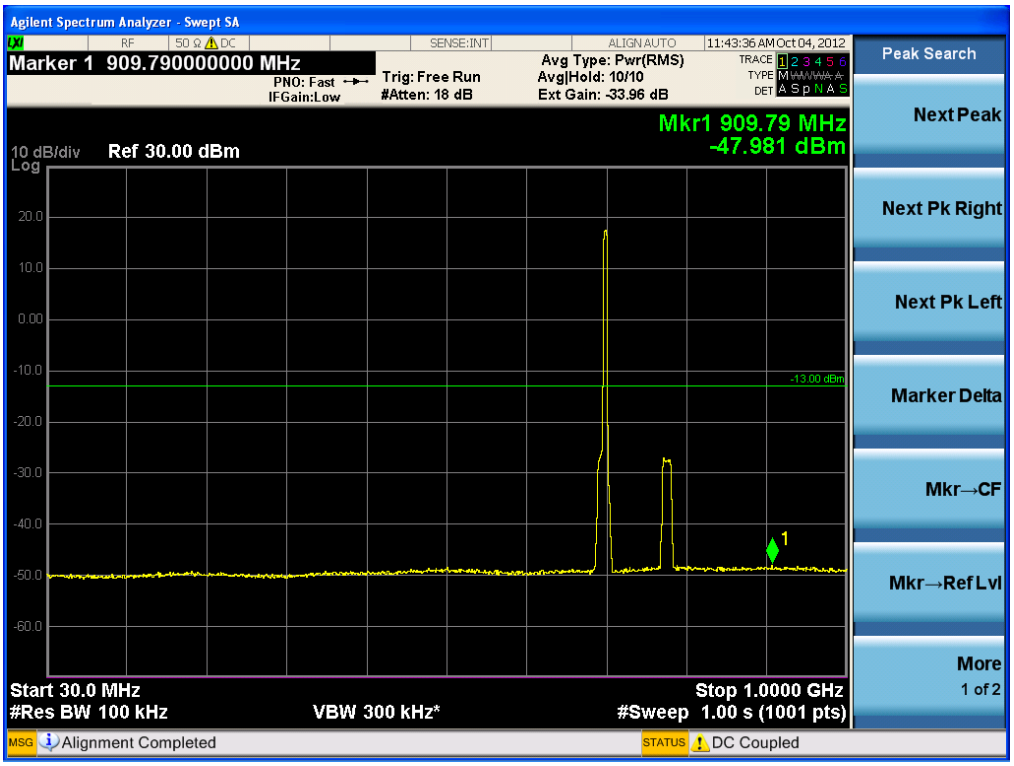
[LTE Downlink C]



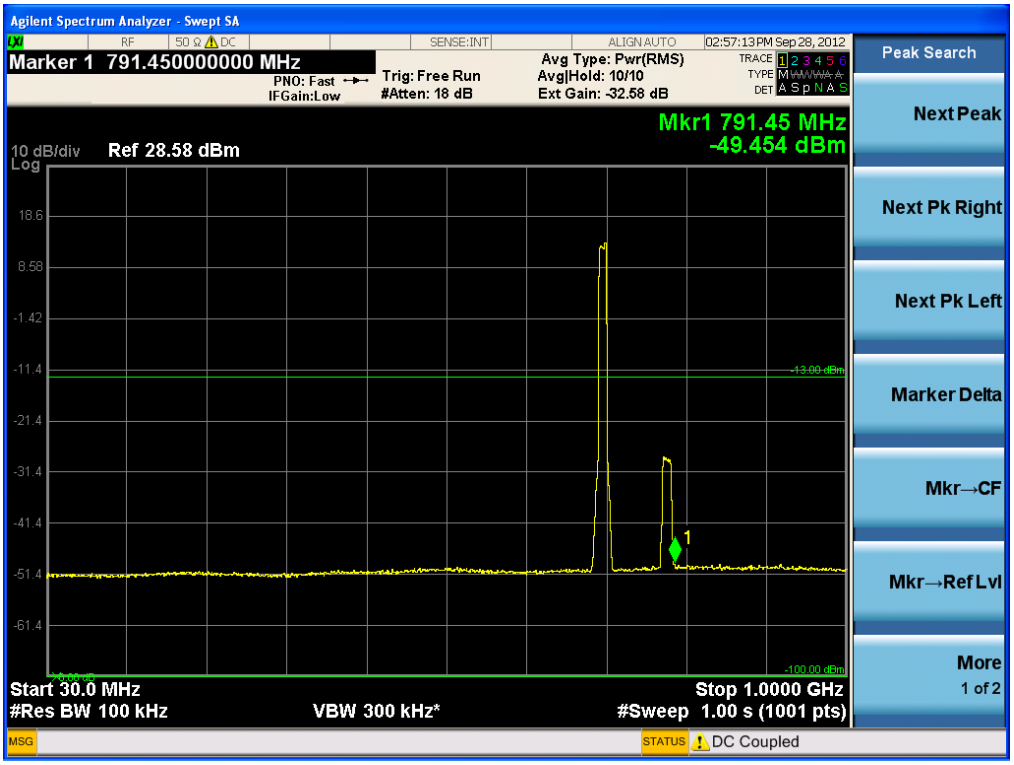
[LTE Uplink A]



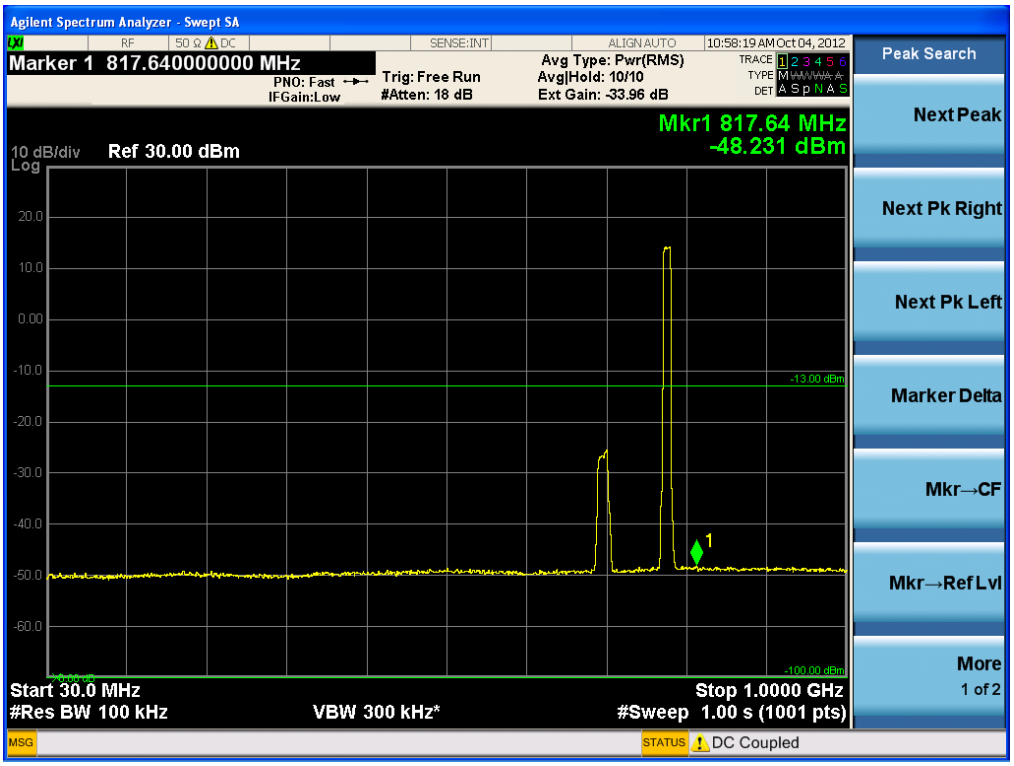
[LTE Uplink B]



[LTE Uplink A+B]



[LTE Uplink C]

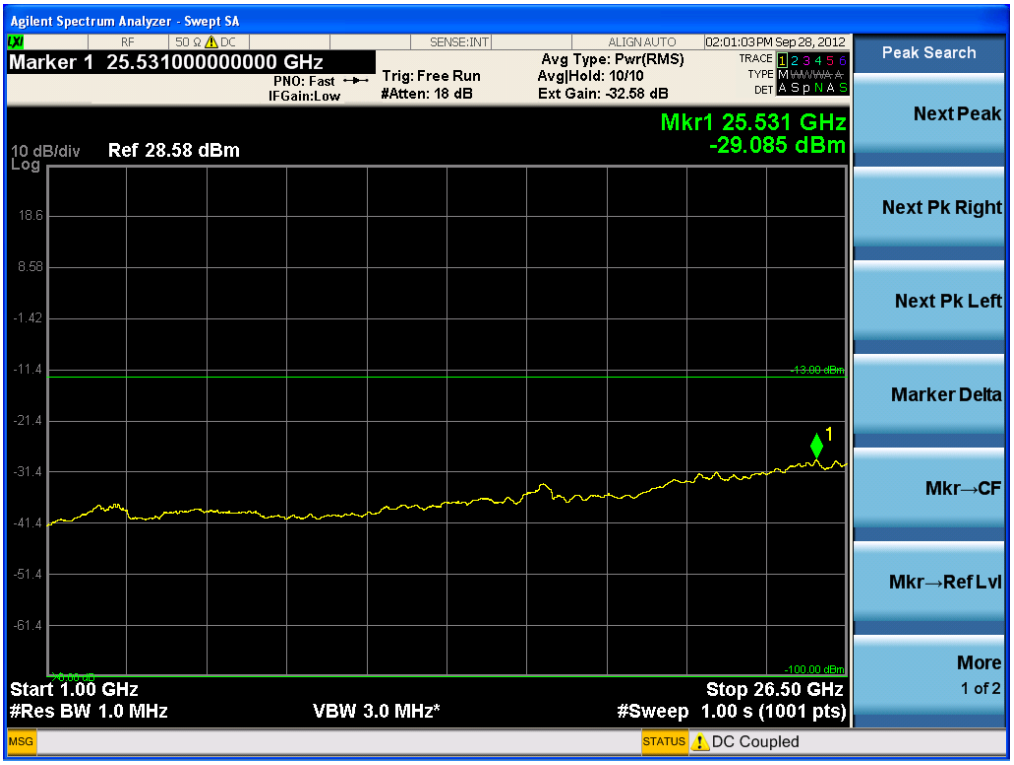


Conducted Spurious Emissions (1 GHz –26.5 GHz)

[LTE Downlink A]

[LTE Downlink B]

[LTE Downlink A+B]



[LTE Downlink C]

[LTE Uplink A]

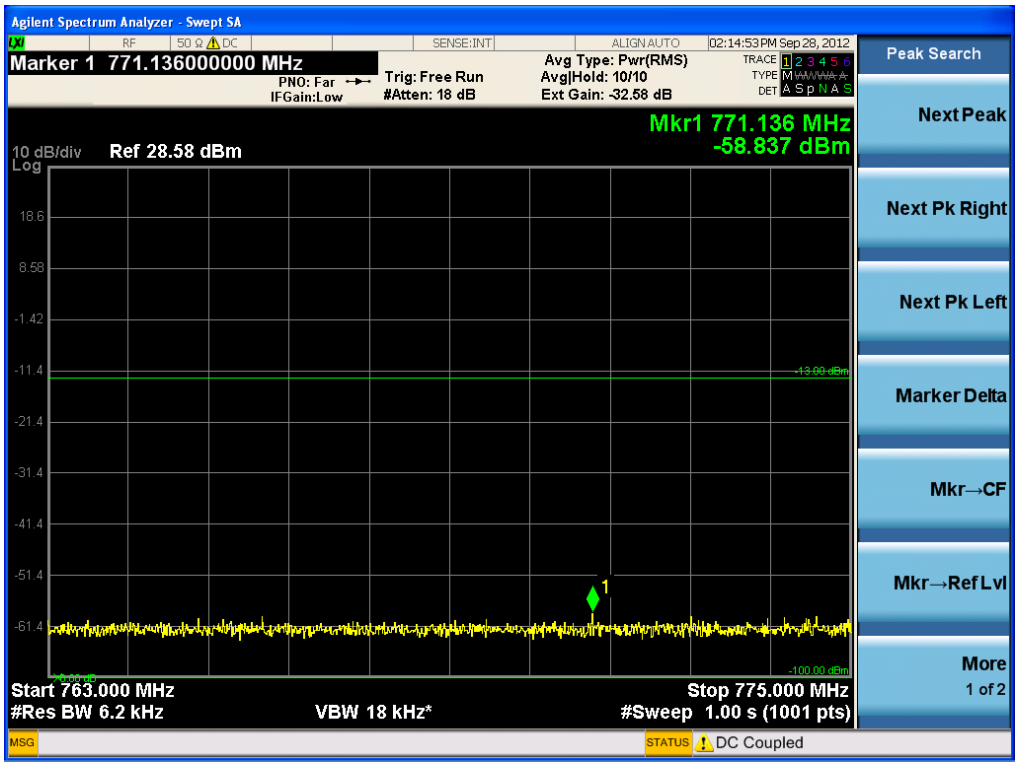
[LTE Uplink B]

[LTE Uplink A+B]

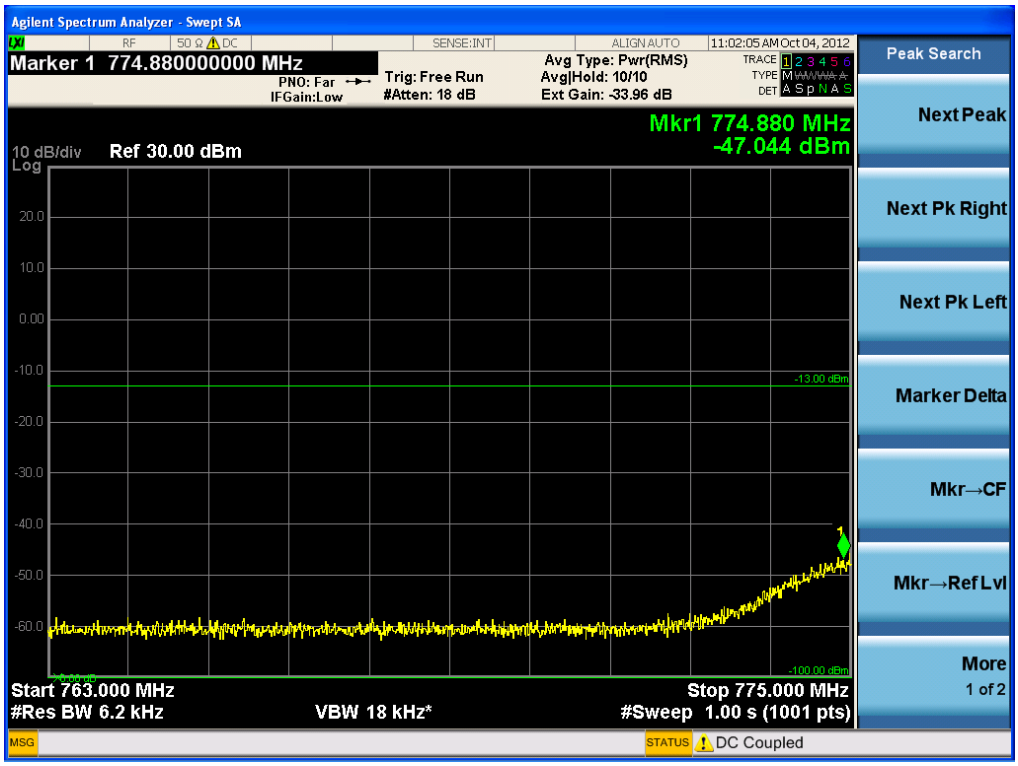
[LTE Uplink C]

Conducted Spurious Emissions (763 MHz – 775 MHz)

[LTE Downlink C]

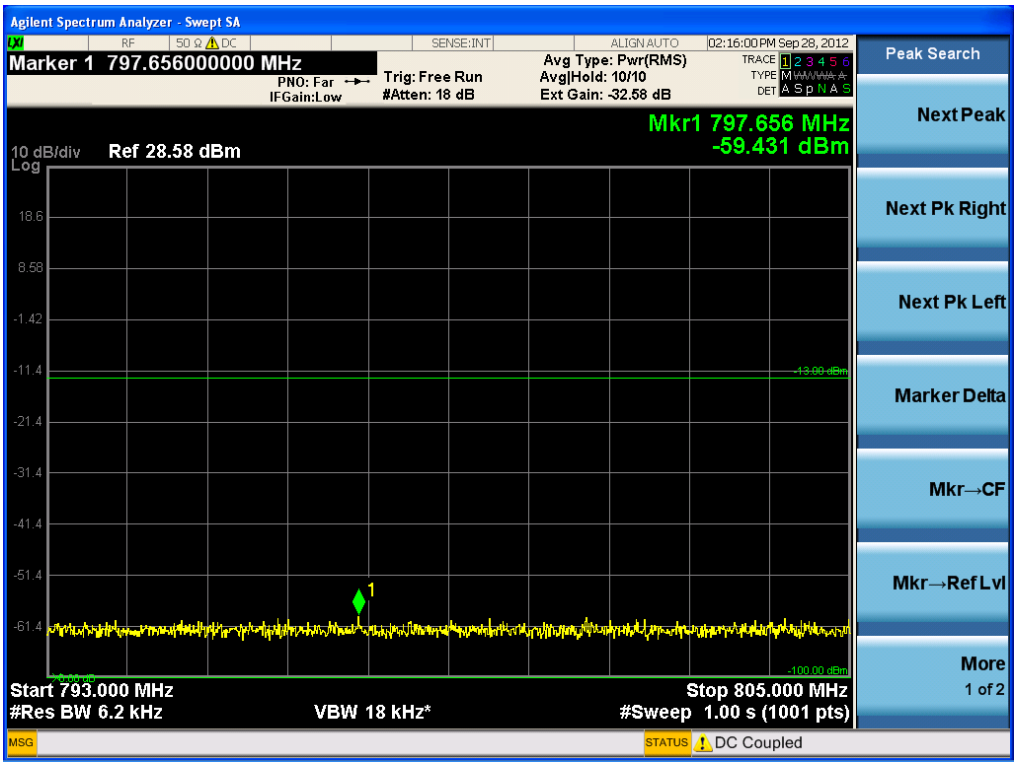


[LTE Uplink C]

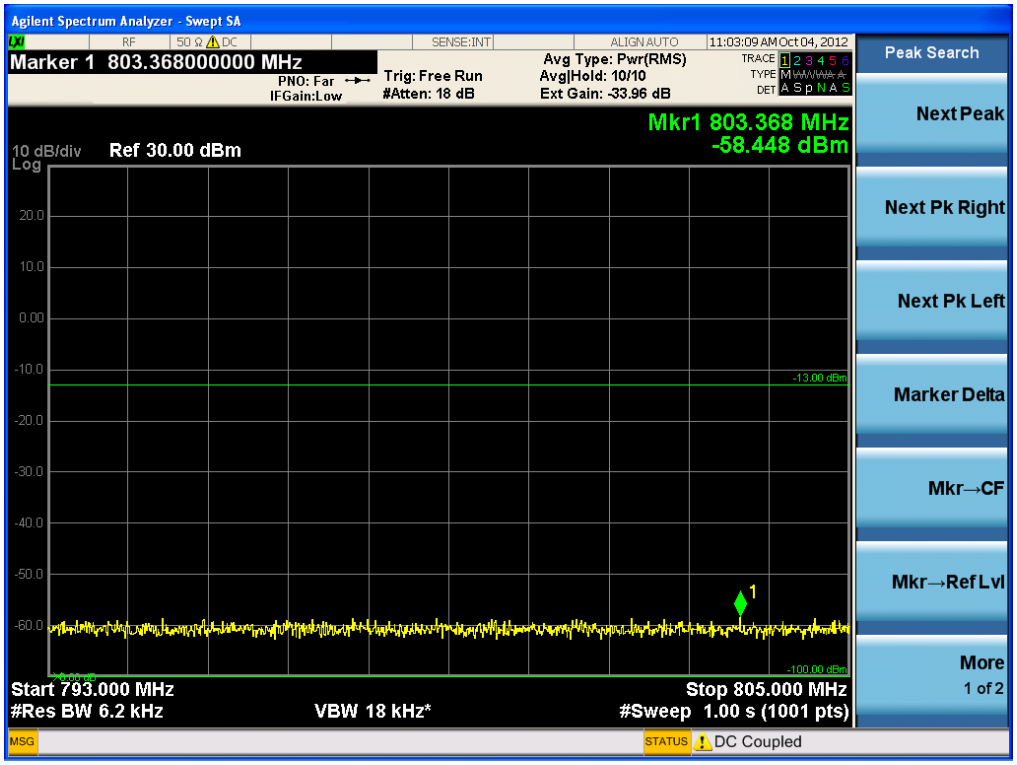


Conducted Spurious Emissions (793 MHz – 805 MHz)

[LTE Downlink C]

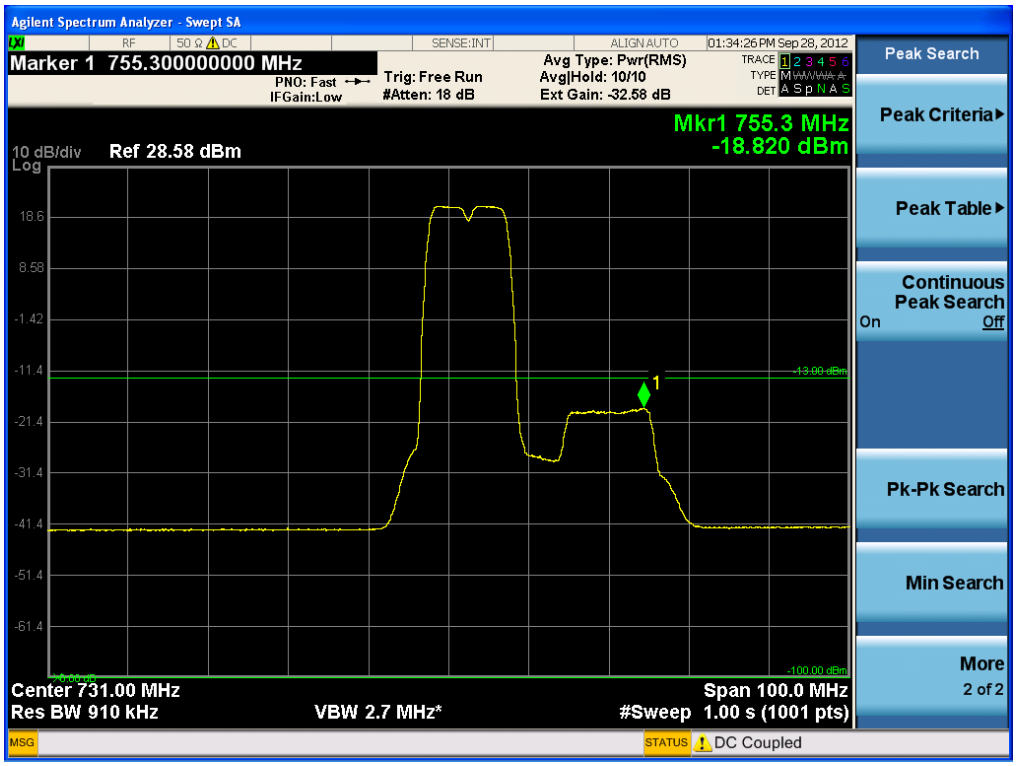


[LTE Uplink C]

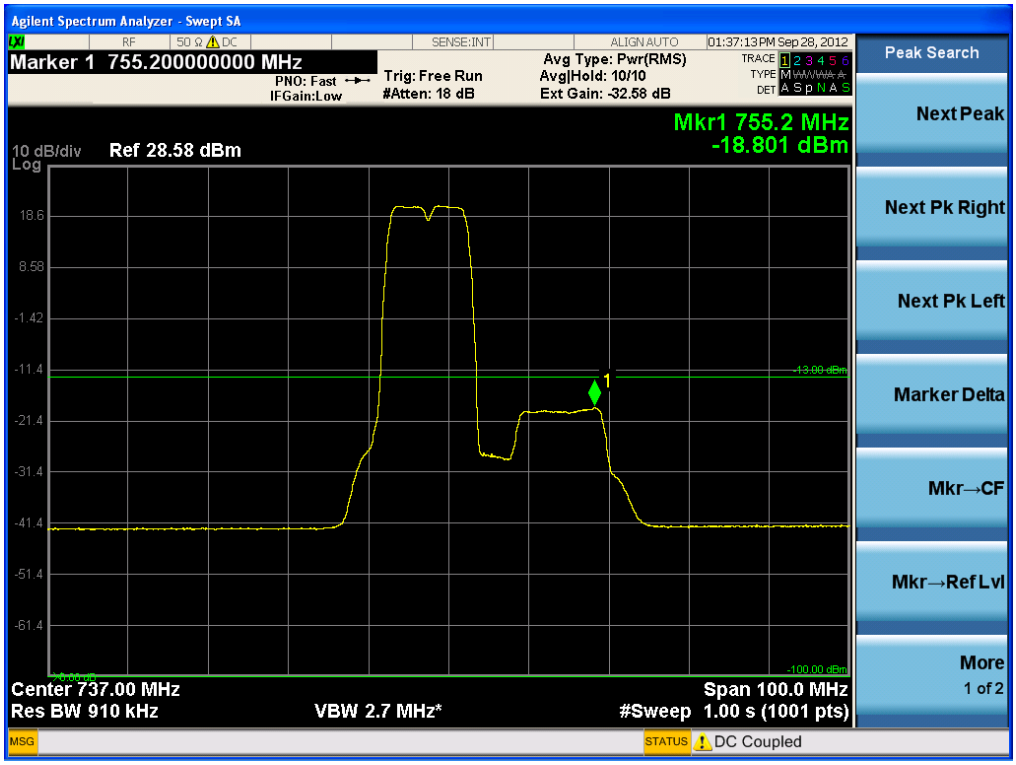


Intermodulation Spurious Emissions

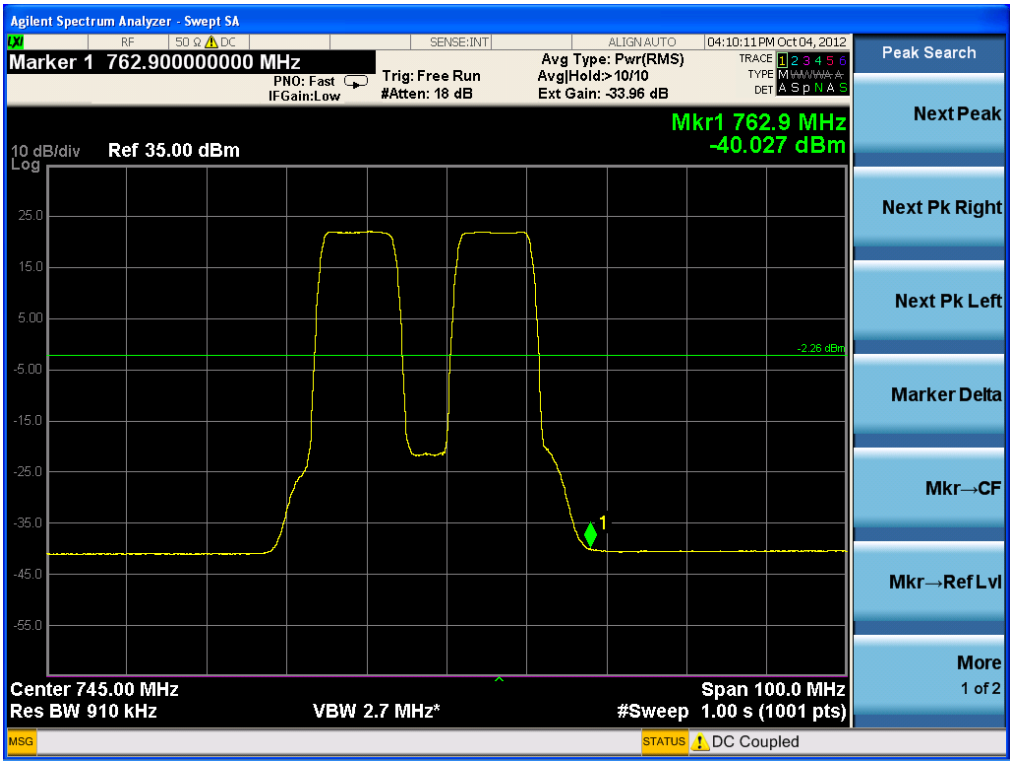
[LTE Downlink A]



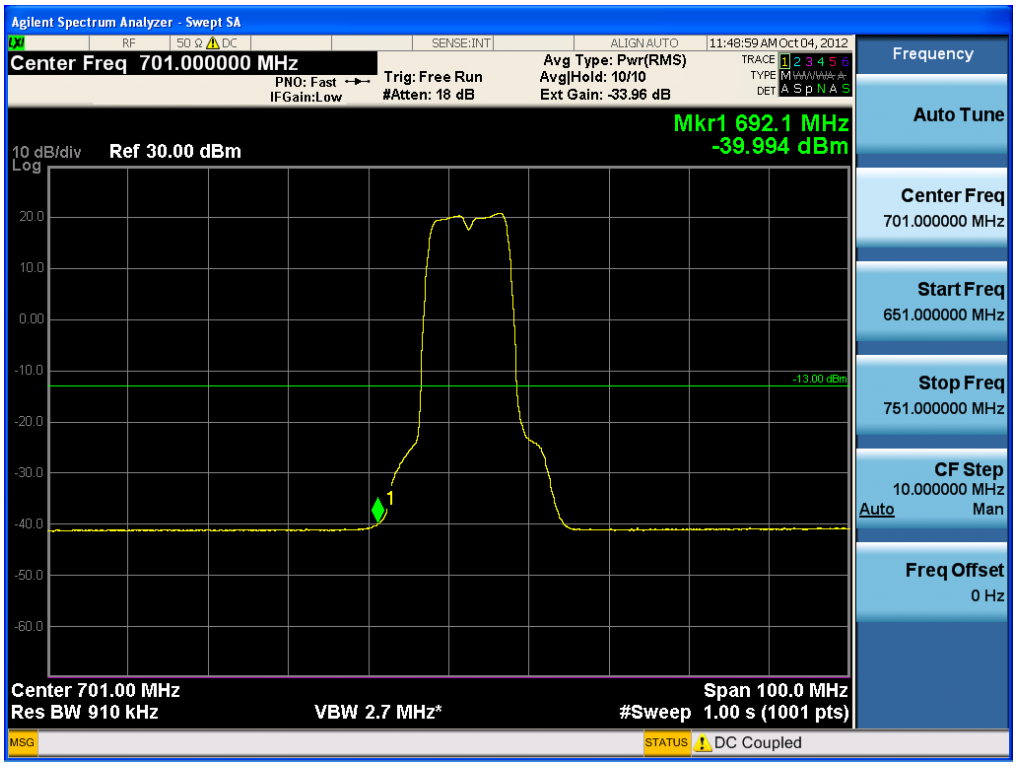
[LTE Downlink B]



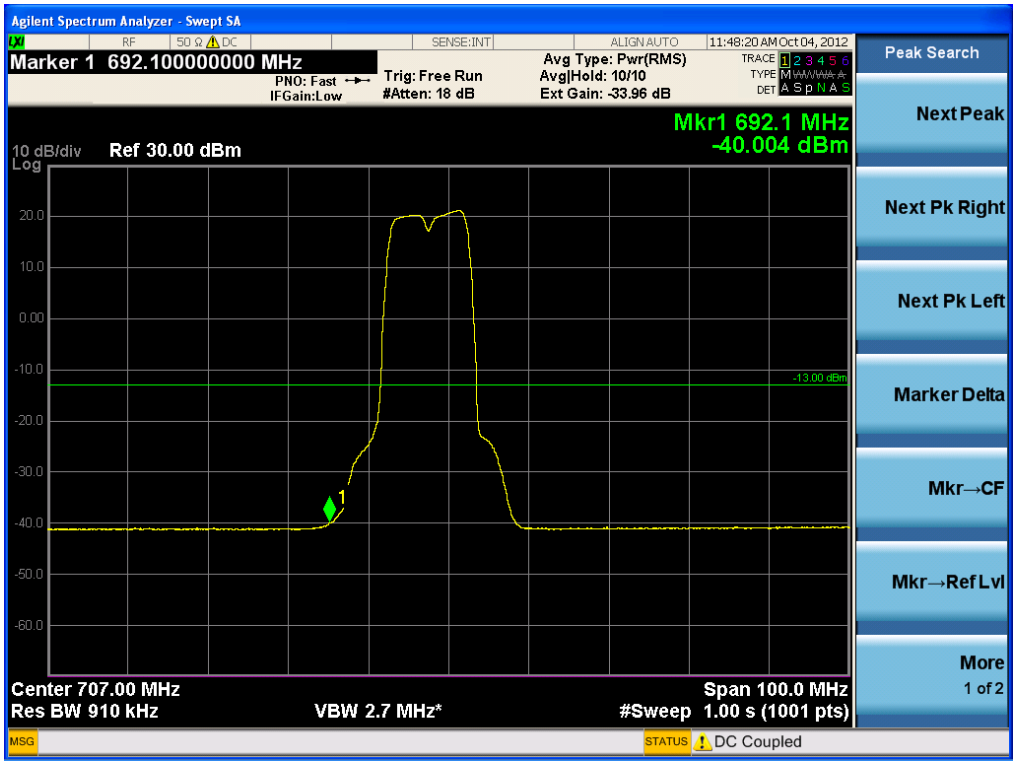
[LTE Downlink A+B]



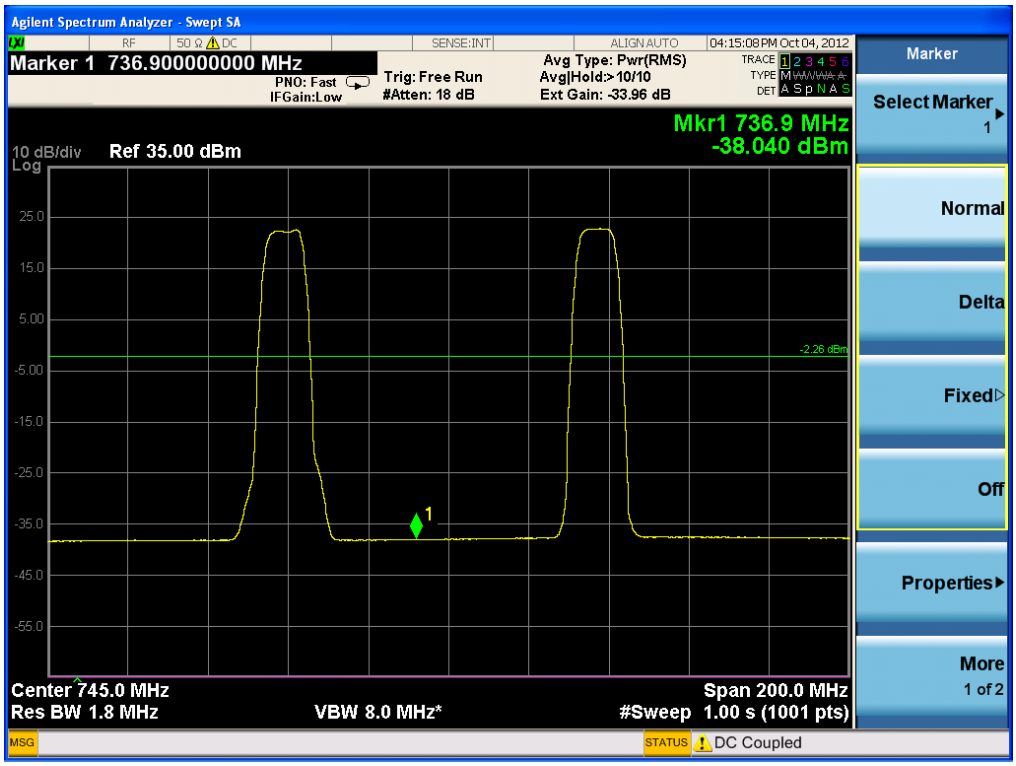
[LTE Uplink A]



[LTE Uplink B]

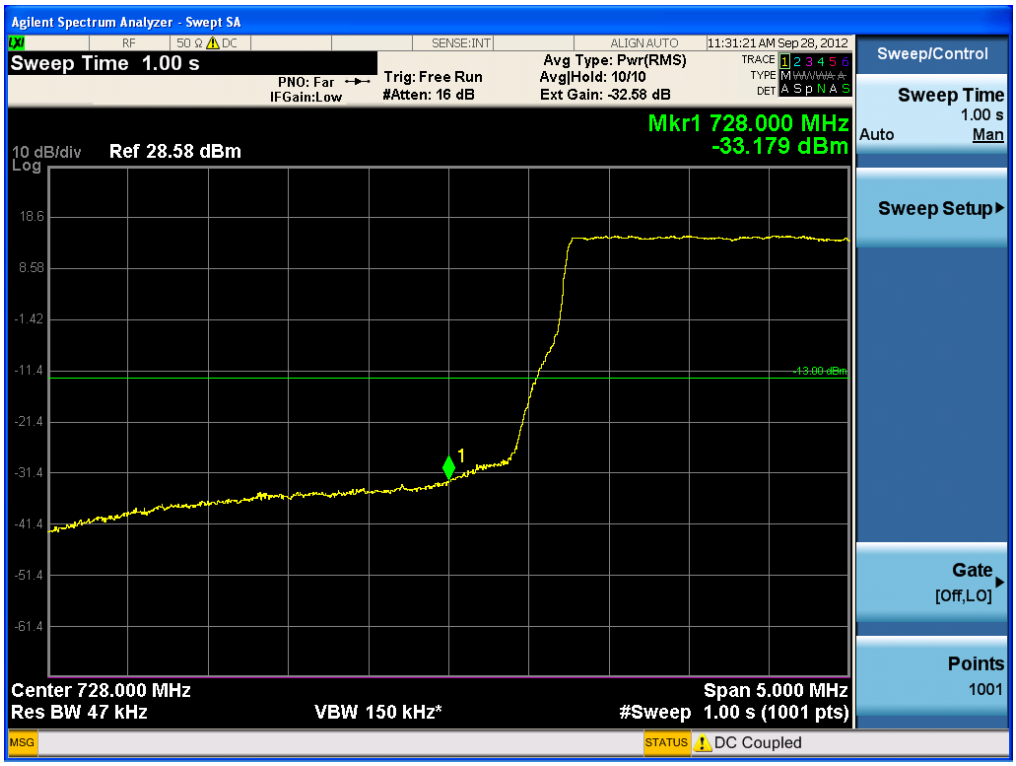


[LTE Uplink A+B]



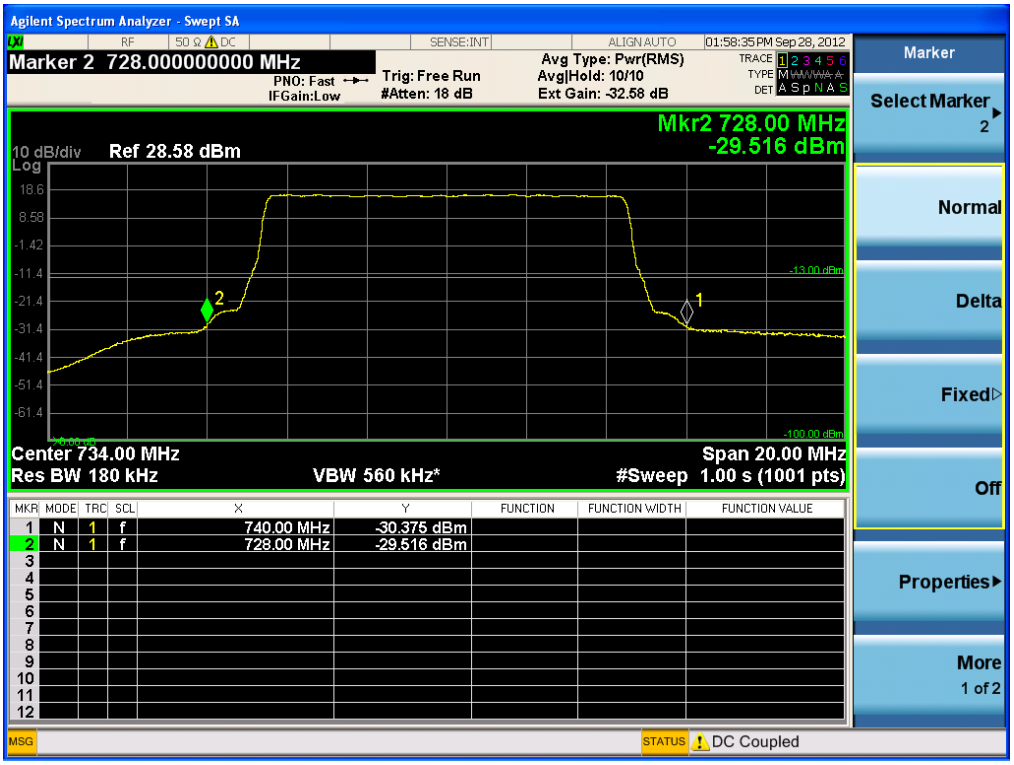
Band Edge

[LTE Downlink A]

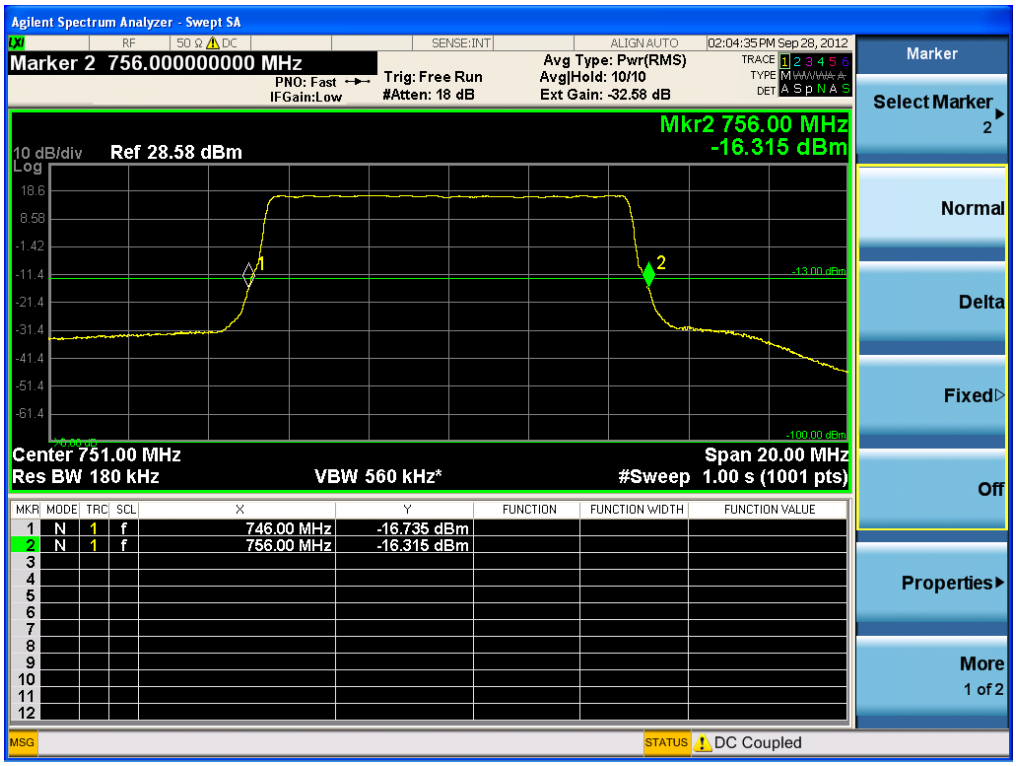


[LTE Downlink B]

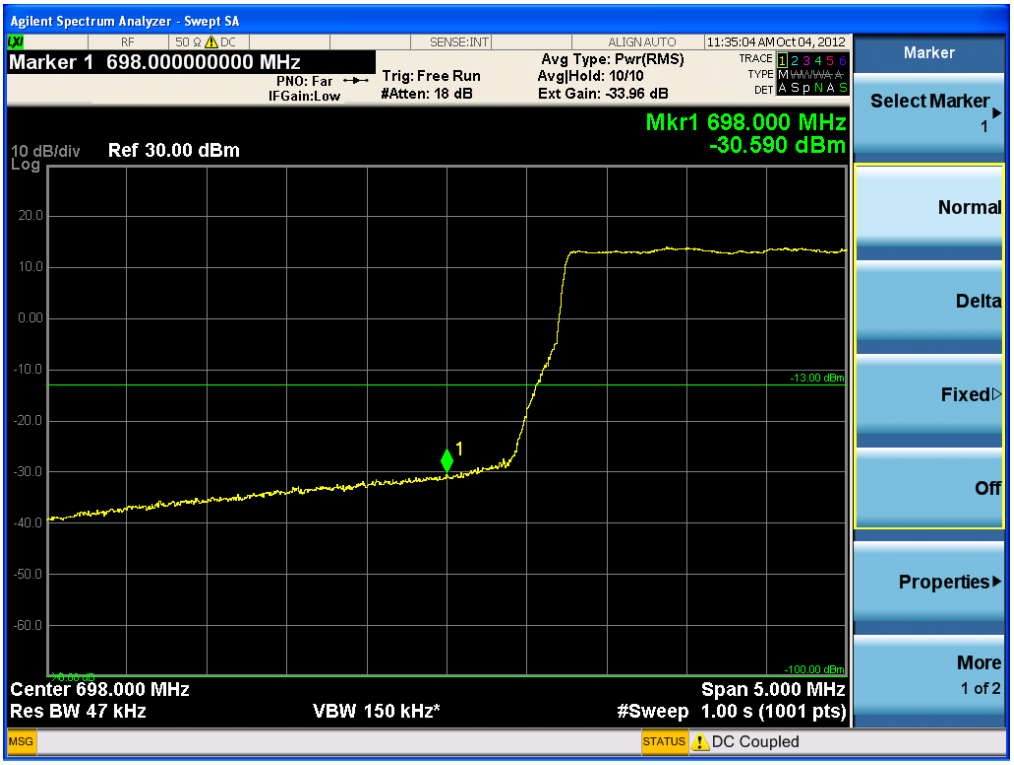
[LTE Downlink A+B]



[LTE Downlink c]

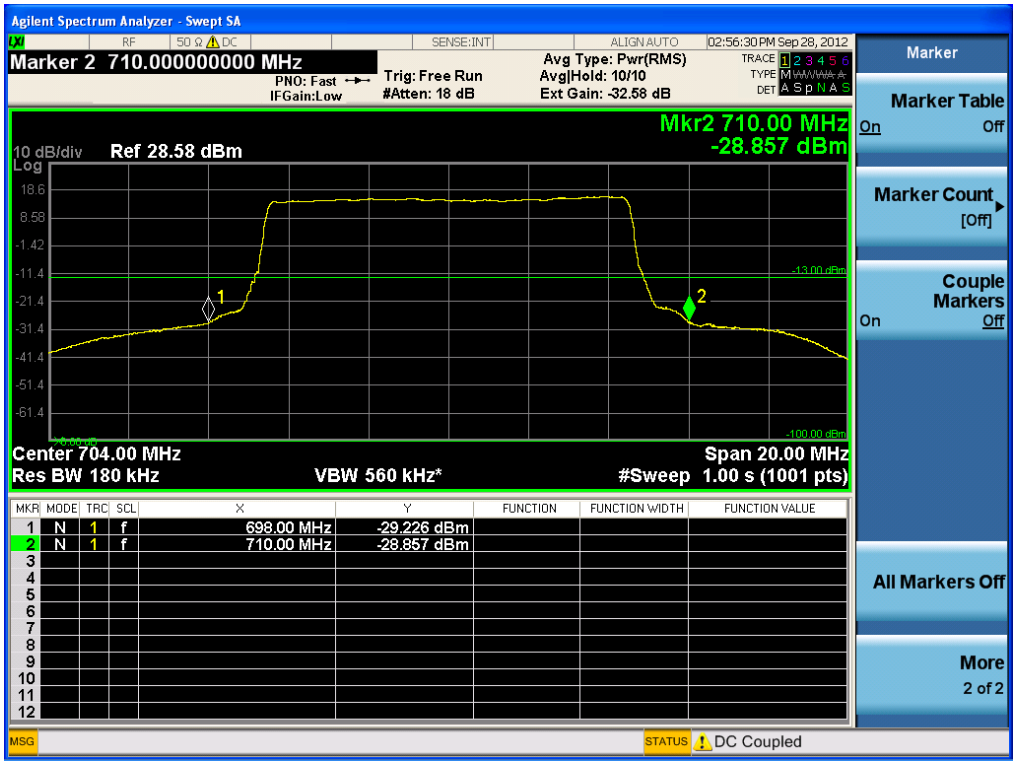


[LTE Uplink A]

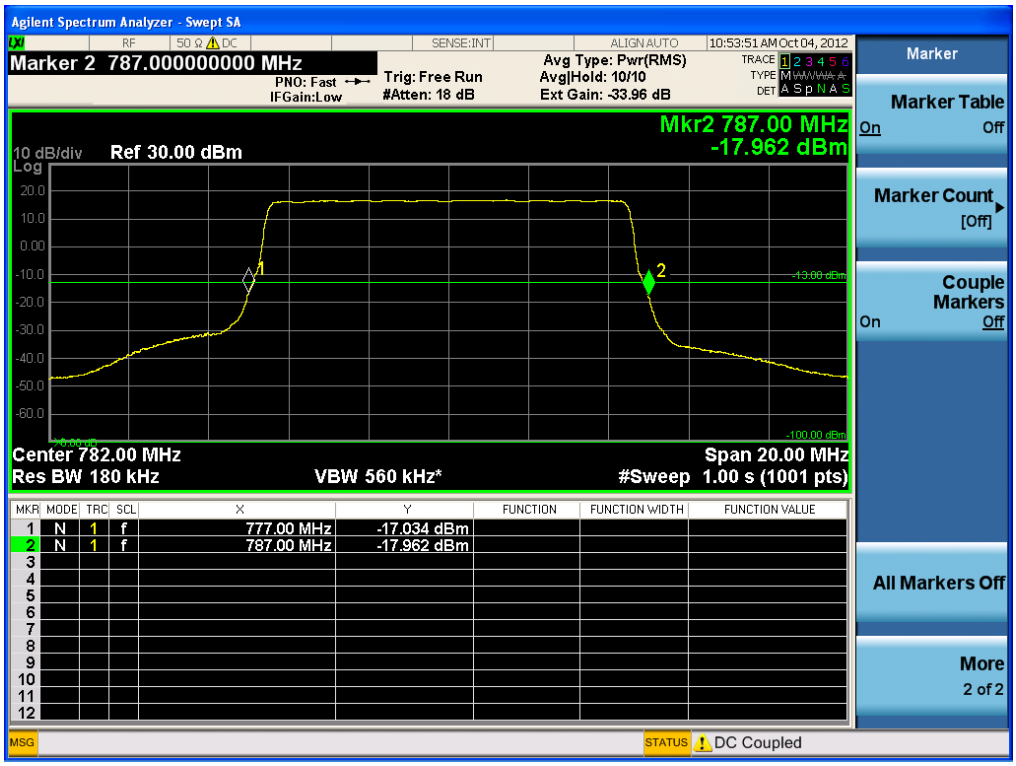


[LTE Uplink B]

[LTE Uplink A+B]



[LTE Uplink C]



8. FIELD STRENGTH OF SPURIOUS RADIATION

Test Requirement(s): § 2.1053 Measurements required: Field strength of spurious radiation.

§ 2.1053 (a) Measurements shall be made to detect spurious emissions that may be Radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

§ 2.1053 (b): The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to The transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

§ 27.53 Emission limit (c) For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(f) For operations in the 746–763 MHz, 775–793 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. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Test Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of TIA/EIA-603-A-2001 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".
Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber.
The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360
and the receiving antenna scanned from 1-3m in order to capture the maximum emission. A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried. out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, whichever was the lesser, were investigated.

Test Results:

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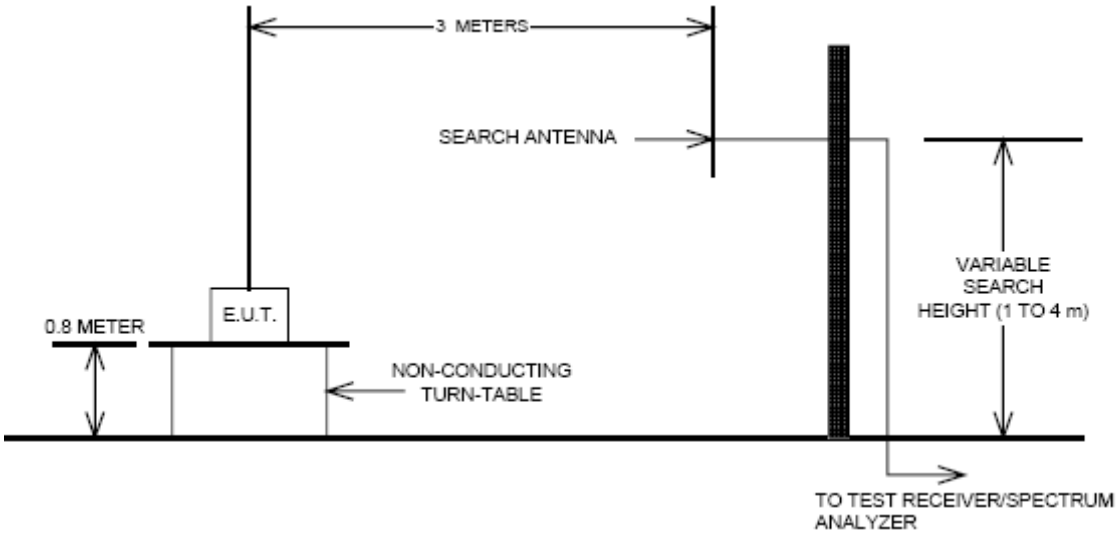
Radiated Spurious Emissions Test Setup



Sample Calculation

Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	C.L	SigGen Level [dBm]	Pol.	EIRP (dBm)	Margin (dB)
1402	-80.34	7.18	4.53	-50.53	H	-47.88	34.88

EIRP = Substitude LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

-47.88 = -50.53 + 7.18 - 4.53

1) The EUT mounted on a table on 0.8 meter above test site ground level.

2) During the test, the turn table is rotated and the antenna height is also varied from 1 to 4 meters until the maximum signal is found.

3) Record the field strength meter's level.

4) Replace the EUT with antenna that is connected to a calibrated signal generator.

5) Increase the signal generator output till the field strength meter's level is equal to the item (3).

6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power (**EIRP**).

[Downlink]

Test Frequency	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	C.L	SigGen Level [dBm]	Pol.	EIRP (dBm)	Margin (dB)
731	1555	-79.65	8.86	4.79	-49.3	H	-45.23	32.23
	2010	-78.27	10.56	5.65	-46.94	H	-42.03	29.03
734	1090	-79.76	5.94	3.9	-50.87	H	-48.83	35.83
	1170	-79.8	6.71	4.07	-50.89	H	-48.25	35.25
	2150	-76.96	10.57	5.88	-44.8	H	-40.11	27.11
751	1436	-78.05	7.55	4.59	-48.12	H	-45.16	32.16
	2098	-77.34	10.56	5.8	-45.51	H	-40.75	27.75

[Uplink]

Test Frequency	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	C.L	SigGen Level [dBm]	Pol.	EIRP (dBm)	Margin (dB)
701	1402	-80.34	7.18	4.53	-50.53	H	-47.88	34.88
	1887	-77.65	10.36	5.44	-46.86	H	-41.94	28.94
707	1650	-79.29	9.56	4.97	-49.3	H	-44.74	31.74
	1965	-77.85	10.52	5.57	-46.7	H	-41.78	28.78
782	1564	-80.11	8.96	4.8	-49.73	H	-45.57	32.57
	2346	-78.25	10.58	6.21	-45.03	H	-40.66	27.66

9. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS

Test Requirement(s): RSS-GEN 4.7 Transmitter Frequency Stability, RSS-131 4.5 Frequency Stability

Frequency stability is a measure of frequency drift due to temperature and supply voltage variations with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage.

The reference temperature for transmitters is +20°C, unless specified otherwise in the applicable RSS to the device.

A hand-held device that is only capable of operating using internal batteries shall be tested using a new battery without any further requirement to vary the supply voltage. Alternatively, an external supply voltage can be used and set at the battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determining circuit element shall be made subsequent to this initial set-up.

With the transmitter installed in an environment test chamber, the unmodulated carrier frequency shall be measured under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement. The following temperatures and supply voltage ranges apply, unless specified otherwise in the applicable RSS.

1. at temperatures of -30°C, +20°C and +50°C, and at the manufacturer's rated supply voltage; and

2. at temperature of +20°C and at ±15 percent of the manufacturer's rated supply voltage.

If the frequency stability limits are only met at a different temperature range than specified in (a), the frequency stability requirement will be deemed met if the transmitter is automatically inhibited from operating outside this different temperature range and, the published equipment operating characteristics are revised to reflect this different temperature range.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained using a frequency counter with gating time set to an appropriately large multiple of symbol periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

Test Procedures: Frequency Stability measurements were made at the RF output terminals using a Spectrum Analyzer.

The EUT was placed in the Environmental Chamber.

A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option

on the Spectrum Analyzer was used to measure frequency deviations.

The frequency drift was investigated for every 10 °C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50 °C.

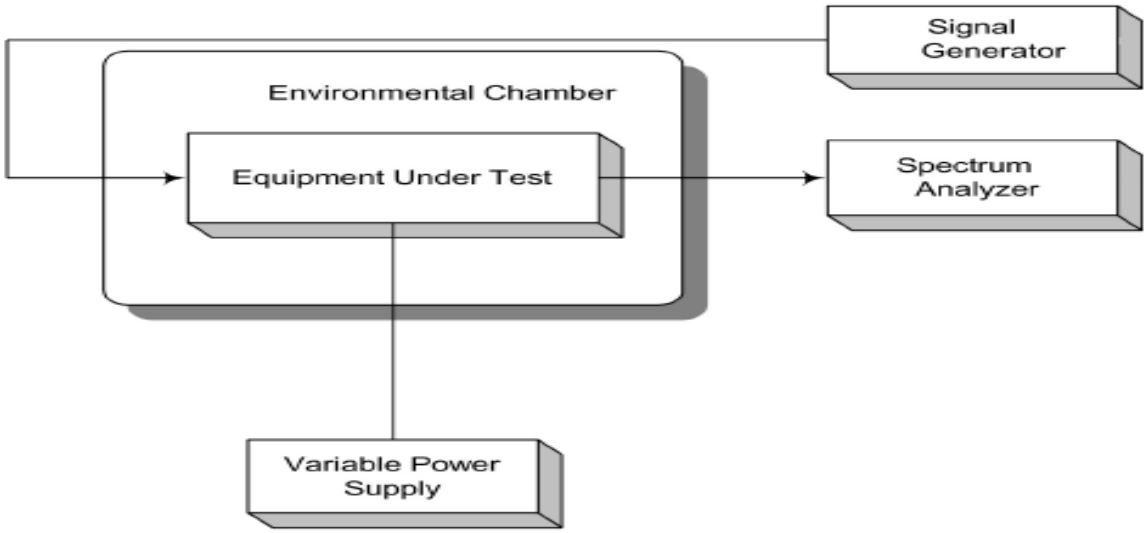
Voltage supplied to EUT is 120 Vac reference temperature was done at 20°C.

The voltage was varied by ± 15 % of nominal

Test Results:

The E.U.T was found in compliance for Frequency Stability and Voltage Test

Test Setup:



Frequency Stability and Voltage Test Results

Reference: 110 Vac at 20°C **Freq.** = 751 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	750 999 992	-7.9	0.0	0.0000
	-30	750 999 992	-7.6	0.3	0.0004
	-20	750 999 992	-8.1	-0.2	-0.0003
	-10	750 999 992	-7.7	0.2	0.0003
	0	750 999 992	-7.9	0.0	0.0000
	+10	750 999 992	-7.8	0.1	0.0001
	+30	750 999 992	-8.1	-0.2	-0.0003
	+40	750 999 992	-8.0	-0.1	-0.0001
	+50	750 999 992	-7.7	0.2	0.0003
115%	+20	750 999 992	-7.9	0.0	0.0000
85%	+20	750 999 992	-7.8	0.1	0.0001

Reference: 110 Vac at 20°C **Freq.** = 782 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	781 999 992	-8.0	0.0	0.0000
	-30	781 999 992	-8.1	-0.1	-0.0001
	-20	781 999 992	-8.0	0.0	0.0000
	-10	781 999 992	-8.0	0.0	0.0000
	0	781 999 992	-8.0	0.0	0.0000
	+10	781 999 992	-8.1	-0.1	-0.0001
	+30	781 999 992	-8.1	-0.1	-0.0001
	+40	781 999 992	-8.0	0.0	0.0000
	+50	781 999 992	-8.1	-0.1	-0.0001
115%	+20	781 999 992	-8.0	0.0	0.0000
85%	+20	782 000 008	7.9	15.9	0.0203

10. RF EXPOSURE STATEMENT

1. LIMITS

According to §1.1310 and §2.1091 RF exposure is calculated.

(B) Limits for General Population/Uncontrolled Exposures

Frequency range (MHz)	Electric field Strength (V/m)	Magnetic field Strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
0.3 - 1.34	614	1.63	*(100)	30
1.34 - 30	824/f	2.19/f	*(180/ f^2)	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	.....	.....	f/1500	30
1500 - 100.000	.....	.....	1.0	30

F = frequency in MHz

* = Plane-wave equivalent power density

2. MAXIMUM PERMISSIBLE EXPOSURE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

S = Power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

2-1 Limit (Down Link)

Max Peak output Power at antenna input terminal	33.110	dBm
Max Peak output Power at antenna input terminal	2.046	W
Prediction distance	50.000	cm
Prediction frequency	734.0000	MHz
Antenna Gain(typical)	2.000	dBi
Antenna Gain(numeric)	1.585	-
Power density at prediction frequency(S)	0.103	mW/cm^2
MPE limit for uncontrolled exposure at prediction frequency	0.489	mW/cm^2

2-2 Limit (Up Link)

Max Peak output Power at antenna input terminal	33.120	dBm
Max Peak output Power at antenna input terminal	2.051	W
Prediction distance	50.000	cm
Prediction frequency	707.0000	MHz
Antenna Gain(typical)	8.000	dBi
Antenna Gain(numeric)	6.310	-
Power density at prediction frequency(S)	0.412	mW/cm^2
MPE limit for uncontrolled exposure at prediction frequency	0.471	mW/cm^2

3. RESULTS

The power density level at 50 cm is 0.103 mW/cm², which is below the uncontrolled exposure limit of 0.489 mW/cm² at Down Link

The power density level at 50 cm is 0.412 mW/cm², which is below the uncontrolled exposure limit of 0.471 mW/cm² at Up Link

Warning: In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, it must also have a minimum distance of 50 cm from the body during normal operation.