

Radio Test Report

Application for a Class II Permissive Change of Equipment Authorization



CERTIFICATE #: 0214.19

FCC Part 24, and IC RSS-133  
[1930MHz – 1990MHz]

FCC Part 27, IC RSS-139, and RSS-170  
[2110MHz – 2170MHz]

FCC ID: VBNAHFIB-01  
IC: 661W-AHFIB

Product Name: Airscale Base Transceiver Station Remote Radio Head  
Model: AHFIB

Applicant: Nokia Solutions and Networks  
6000 Connection Drive  
Irving, TX 75039

Test Sites: Nokia Solutions and Networks  
6000 Connection Drive  
Irving, TX 75039 and  
National Technical Systems – Plano  
1701 E Plano Pkwy #150  
Plano, TX 75074

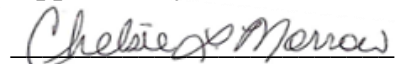
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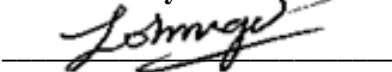
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**REVISION HISTORY**

| Rev# | Date       | Comments      | Modified By      |
|------|------------|---------------|------------------|
| 0    | 12/07/2018 | Initial Draft | Christian Booker |
|      |            |               |                  |
|      |            |               |                  |

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**SCOPE**

Tests have been performed on Nokia Solutions and Networks product Airscale Base Station Remote Radio Head (RRH) Model AHFIB, pursuant to the relevant requirements of the following standard(s) to obtain device certification against the regulatory requirements of the Federal Communications Commission (FCC) and Innovation, Science and Economic Development Canada (ISED).

- Code of Federal Regulations (CFR) Title 47 Part 2
- (Radio Standards Specification) RSS-Gen Issue 5, April 2018
- CFR Title 47 Part 24 Subpart E – Broadband PCS
- RSS-133 Issue 6, Amendment 1 - January 18, 2018 (2GHz Personal Communications Services)
- CFR Title 47 Part 27 Subpart C & L
- RSS-139 Issue 3- July 16, 2015

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards:

ANSI C63.26-2015  
ANSI C63.4-2014  
ANSI TIA-603-E  
FCC KDB 971168 D01 v03r01  
FCC KDB 971168 D03 v01  
FCC KDB 662911D01 v02r01  
TIA-102.CAAA-D

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC requirements.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of Nokia Solutions and Networks product Airscale Base Station Remote Radio Head (RRH) Model AHFIB and therefore apply only to the tested sample. The sample was selected and prepared by Hobert Smith and John Rattanavong of Nokia Solutions and Networks.

**OBJECTIVE**

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA and Canada, the device requires certification.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

Testing was performed only on Model AHFIB. No additional models were described or supplied for testing.

**STATEMENT OF COMPLIANCE**

The tested sample of Nokia Solutions and Networks product Airscale Base Transceiver Station Remote Radio Head (RRH) Model AHFIB complied with the requirements of the standards and frequency bands declared in the scope of this test report.

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

**DEVIATIONS FROM THE STANDARDS**

No deviations were made from the published requirements listed in the scope of this report.

**TEST RESULTS SUMMARY**

The following tables provide a summary of the test results:

**FCC Part 24 and IC RSS-133 (Base Stations Operating in the 1930MHz to 1990MHz Band)**

| AHFIB operating in the PCS Band   |                             |   |  |                              |                   |
|---|-----------------------------|---|--|------------------------------|-------------------|
| FCC   | IC                          | Description                                 | Measured   | Limit                        | Results           |
| <b>Transmitter Modulation, output power and other characteristics</b>   |                             |   |  |                              |                   |
| 24.229  | RSS-133<br>Section<br>6.1   | Frequency Ranges                            | WCDMA: 1932.4 – 1987.6MHz<br>GSM/EDGE: 1930.2 – 1989.8MHz  | 1930.0 – 1990.0MHz           | Pass              |
| 2.1047  | RSS-133<br>Section<br>6.2   | Modulation Type                             | WCDMA: QPSK, 16QAM, 64QAM<br>GSM: GMSK<br>EDGE: 8-PSK  | Digital                      | Pass              |
| 24.232  | RSS-133<br>Section<br>6.4   | Output Power                                | Highest Conducted Power Output RMS:<br>46.4dBm<br>EIRP depends on antenna gain which is<br>unknown | 1640W/MHz<br>EIRP/MHz        | Pass              |
| 24.232  | RSS-133<br>Section<br>6.4   | Peak to Average<br>Power Ratio              | Highest Measured PAPR: 8.1dB   | 13dB                         | Pass              |
|   | RSS-133<br>Section<br>2.3   | 99%<br>Emission<br>Bandwidth                | WCDMA: 3.947MHz<br>GMSK: 247kHz<br>8PSK: 243kHz  | Remain in Block              | Pass              |
| 24.238  |                             | 26dB down<br>Emission<br>Bandwidth          | WCDMA: 4.374MHz<br>GMSK: 323kHz<br>8PSK: 311kHz  | Remain in Block              | Pass              |
| <b>Transmitter Spurious Emissions<sup>1</sup></b>   |                             |   |  |                              |                   |
| 24.238  | RSS-133<br>Section<br>6.5.1 | At the antenna<br>terminals for<br>GSM/EDGE | < -13dBm   | -13dBm<br>per Transmit Chain | Pass              |
|   |                             | At the antenna<br>terminals for<br>WCDMA    | < -16dBm   | -16dBm<br>per Transmit Chain | Pass              |
|   |                             | Field Strength                              | < -13dBm   | -13dBm EIRP                  | Pass <sup>2</sup> |
| <b>Other Details</b>  |                             |   |  |                              |                   |
| 24.235  | RSS-133                     | Frequency<br>Stability                      | Stays within authorized frequency block  | Stays within block           | Pass <sup>2</sup> |
| 1.1310  | RSS-102                     | RF Exposure                                 | N/A  |                              | Pass <sup>3</sup> |
| Note 1: Based on 1MHz RBW. In the 1MHz immediately outside and adjacent to the frequency block a RBW of at least 1% of the emission bandwidth was used. The measurement bandwidth is 1MHz for measurements more than 1MHz from the band edge.<br>Note 2: See the original FCC and IC radio certification report for details (NTS Test Report Number PR072254 Rev.1 dated March 16, 2018).<br>Note 3: Applicant's declaration on a separate exhibit based on hypothetical antenna gains. |                             |   |  |                              |                   |

| WCDMA Emission Designators for the PCS Band                                     |         |           |         |           |         |
|---|---------|-----------|---------|-----------|---------|
| LTE-QPSK  |         | LTE-16QAM |         | LTE-64QAM |         |
| FCC   | IC      | FCC       | IC      | FCC       | IC      |
| 4M36F9W   | 3M95F9W | 4M37F9W   | 3M95F9W | 4M37F9W   | 3M94F9W |
| Note: FCC based on 26dB emission bandwidth; IC based on 99% emission bandwidth. |         |           |         |           |         |

| GSM/EDGE Emission Designators for the PCS Band                                  |         |            |         |
|---|---------|------------|---------|
| GSM -GMSK   |         | EDGE -8PSK |         |
| FCC   | IC      | FCC        | IC      |
| 323KGXW   | 247KGXW | 311KG7W    | 243KG7W |
| Note: FCC based on 26dB emission bandwidth; IC based on 99% emission bandwidth. |         |            |         |

**FCC Part 27 Subpart C&L/IC RSS-139 (Base Stations Operating in the 2110 - 2170MHz Band)**

| AHFIB operating in the AWS Band   |                 |                              |  |                           |                   |
|---|-----------------|------------------------------|--|---------------------------|-------------------|
| FCC   | IC              | Description                  | Measured   | Limit                     | Results           |
| <b>Transmitter Modulation, output power and other characteristics</b>   |                 |                              |  |                           |                   |
| 27.5(h)&(j)   | RSS-139 Sec 6.1 | Frequency Ranges             | WCDMA: 2112.4 – 2167.6MHz  | 2110.0 – 2170.0MHz        | Pass              |
| 2.1033(c)(4)  | RSS-139 Sec 6.2 | Modulation Type              | WCDMA: QPSK, 16QAM, 64QAM  | Digital                   | Pass              |
| 27.50(d)(2)   | RSS-139 Sec 6.5 | Output Power                 | Highest Conducted Power Output RMS: 46.4dBm<br>EIRP depends on antenna gain which is unknown | 1640W/MHz<br>EIRP/MHz     | Pass              |
| 27.50(d)(5)   | RSS-139 Sec 6.5 | Peak to Average Power Ratio  | Highest Measured PAPR: 8.0dB   | 13dB                      | Pass              |
|   | RSS-Gen Sec 6.6 | 99% Emission Bandwidth       | WCDMA: 3.947MHz  | Remain in Block           | Pass              |
| 27.53(h)(3)   |                 | 26dB down Emission Bandwidth | WCDMA: 4.374MHz  | Remain in Block           | Pass              |
| <b>Transmitter Spurious Emissions<sup>1</sup></b>   |                 |                              |  |                           |                   |
| 27.53(h)  | RSS-139 Sec 6.6 | At the antenna terminals     | < -16dBm   | -16dBm per Transmit Chain | Pass              |
|   |                 | Field strength               | < -13dBm   | -13 dBm EIRP              | Pass <sup>2</sup> |
| <b>Other Details</b>  |                 |                              |  |                           |                   |
| 27.54   | RSS-139 Sec 6.4 | Frequency Stability          | Stays within authorized frequency block  | Stays within block        | Pass <sup>2</sup> |
| 1.1310  | RSS102          | RF Exposure                  | N/A  |                           | Pass <sup>3</sup> |
| Note 1: Based on 1MHz RBW. In the 1MHz immediately outside and adjacent to the frequency block a RBW of at least 1% of the emission bandwidth was used. The measurement bandwidth is 1MHz for measurements more than 1MHz from the band edge.<br>Note 2: See the original FCC and IC radio certification report for details (NTS Test Report Number PR072254 Rev.1 dated March 16, 2018).<br>Note 3: Applicant's declaration on a separate exhibit based on hypothetical antenna gains. |                 |                              |  |                           |                   |

| WCDMA Emission Designators for the AWS Band                                     |         |           |         |           |         |
|---|---------|-----------|---------|-----------|---------|
| LTE-QPSK  |         | LTE-16QAM |         | LTE-64QAM |         |
| FCC   | IC      | FCC       | IC      | FCC       | IC      |
| 4M36F9W   | 3M95F9W | 4M37F9W   | 3M95F9W | 4M37F9W   | 3M94F9W |
| Note: FCC based on 26dB emission bandwidth; IC based on 99% emission bandwidth. |         |           |         |           |         |



**Extreme Conditions**

Frequency stability is determined over extremes of temperature and voltage.

The extremes of voltage were 85 to 115 percent of the nominal value.

The extremes of temperature were -30°C to +50°C as specified in FCC §2.1055(a)(1).

**Measurement Uncertainties**

Measurement uncertainties of the test facility based on a 95% confidence level are as follows:

| <b>Test</b>                  | <b>Uncertainty</b> |
|------------------------------|--------------------|
| Radio frequency              | ± 0.2ppm           |
| RF power conducted           | ±1.2 dB            |
| RF power radiated            | ±3.3 dB            |
| RF power density conducted   | ±1.2 dB            |
| Spurious emissions conducted | ±1.2 dB            |
| Adjacent channel power       | ±0.4 dB            |
| Spurious emissions radiated  | ±4 dB              |
| Temperature                  | ±1°C               |
| Humidity                     | ±1.6 %             |
| Voltage (DC)                 | ±0.2 %             |
| Voltage (AC)                 | ±0.3 %             |

## **EQUIPMENT UNDER TEST (EUT) DETAILS**

### **General**

A class II permissive change on the original filing is being pursued to add GSM/EDGE and WCDMA technologies to the Airscale BTS AHFIB RRH Federal Communication Commission and Industry Canada certifications. The original FCC and IC radio certification submittal was NTS Test Report Number PR072254 Revision 1 dated March 16, 2018. The original test effort includes testing for LTE technologies. Please refer to the test report on the original certification for details on all required testing.

All conducted RF testing performed for the original certification testing has been repeated using GSM, EDGE and WCDMA modulation types for this class II permissive change per correspondence/guidance from Nemko TCB. The same test methodology used in the original certification testing was used in this class II permissive change test effort. Tests performed under the class II change effort include RF power, peak to average power ratio, emission bandwidth (99% and 26 dB down), band edge spurious emissions ( $\pm$  1MHz), and conducted spurious emissions.

The testing was performed on the same hardware (EUT) as the original certification test. The same EUT RF port (Ant 2) determined in the original certification testing to be the highest power port was used for all testing in this effort. The base station and remote radio head software for this testing is an updated release that includes the GSM, EDGE and WCDMA modulation types.

The radiated emissions and frequency stability measurements performed in the original certification was not repeated under this effort per TCB guidance. The radiated emission and frequency stability/accuracy results from the original certification had sufficient margin to preclude requiring additional testing. The same frequency stability/accuracy radio design is the same for all radio technologies/modulation types.

The AHFIB channel numbers and frequencies for GSM/EDGE and WCDMA modes are as follows:

The GSM/EDGE channel bandwidth is 200kHz. The minimum spacing between adjacent GSM/EDGE carriers is 400kHz. The maximum RF bandwidth is 37.5MHz (for rated power) for GSM carriers on the same antenna port. The spacing is 200 kHz between channel numbers.

|                                     | Downlink ARFCN<br>PCS 1900 | Downlink Frequency (MHz) | GSM/EDGE Channels                             |
|-------------------------------------|----------------------------|--------------------------|---|
| PCS Band_ AHFIB Antennas 1, 2, 3, 4 | .....                      | 1930.0                   | Band Edge                                     |
|                                     | 512                        | 1930.2                   | Bottom Channel                                |
|                                     | 513                        | 1930.4                   | Bottom Channel + 1                            |
|                                     | .....                      |                          |   |
|                                     | 624                        | 1952.6                   | Max spacing from upper band edge: UBE-37.4MHz |
|                                     | .....                      |                          |   |
|                                     | 661                        | 1960.0                   | Middle Channel                                |
|                                     | .....                      |                          |   |
|                                     | 698                        | 1967.4                   | Max spacing from lower band edge: LBE+37.4MHz |
|                                     | .....                      |                          |   |
|                                     | 809                        | 1989.6                   | Top Channel - 1                               |
|                                     | 810                        | 1989.8                   | Top Channel                                   |
| .....                               | 1990.0                     | Band Edge                |   |

AHFIB Downlink Band Edge GSM/EDGE PCS Band Frequency Channels

**Multicarrier Multiband Test Cases:**

- (1) In the PCS band: Three GSM/EDGE carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (ARFCN 512: 1930.2 & ARFCN 514: 1930.6MHz) and a third carrier with maximum spacing between the other two carrier frequencies (ARFCN 698: 1967.4MHz). In the AWS band: Single WCDMA carrier with 64QAM at the middle channel (UARFCN 3250: 2140MHz).
- (2) In the PCS band: Three GSM/EDGE carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at upper band edge (ARFCN 808: 1989.4 & ARFCN 810: 1989.8MHz) and a third carrier with maximum spacing between the other two carrier frequencies (ARFCN 624: 1952.6MHz). In the AWS band: Single WCDMA carrier with 64QAM at the middle channel (UARFCN 3250: 2140MHz).

The WCDMA channel bandwidth is 5MHz. The channel spacing is 200 kHz between channel numbers.

|                                     | Downlink UARFCN<br>UTRA Band II | Downlink Frequency (MHz) | WCDMA Channel      |
|-------------------------------------|---------------------------------|--------------------------|--------------------|
| PCS Band_ AHFIB Antennas 1, 2, 3, 4 | 9660                            | 1930.0                   | Band edge          |
|                                     | .....                           |                          |                    |
|                                     | 9662                            | 1932.4                   | Bottom Channel     |
|                                     | 9663                            | 1932.6                   | Bottom Channel + 1 |
|                                     | .....                           |                          |                    |
|                                     | 9800                            | 1960.0                   | Middle Channel     |
|                                     | .....                           |                          |                    |
|                                     | 9937                            | 1987.4                   | Top Channel - 1    |
|                                     | 9938                            | 1987.6                   | Top Channel        |
|                                     | .....                           |                          |                    |
|                                     | 9940                            | 1990.0                   | Band edge          |

AHFIB Downlink Band edge WCDMA PCS Band Frequency Channels

**Multicarrier Multiband Test Case:**

In the PCS band: Three carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (UARFCN 9662: 1932.4 & UARFCN 9687: 1937.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (UARFCN 9938: 1987.6MHz) at the upper band edge. In the AWS band: Single WCDMA carrier at the middle channel (UARFCN 3250: 2140MHz).

The WCDMA channel bandwidth is 5MHz. The channel spacing is 200 kHz between channel numbers.

|                                     | Downlink UARFCN<br>UTRA Band X | Downlink Frequency (MHz) | WCDMA Channel      |
|-------------------------------------|--------------------------------|--------------------------|--------------------|
| AWS Band_ AHFIB Antennas 1, 2, 3, 4 | 3100                           | 2110.0                   | Band edge          |
|                                     | .....                          |                          |                    |
|                                     | 3112                           | 2112.4                   | Bottom Channel     |
|                                     | 3113                           | 2112.6                   | Bottom Channel + 1 |
|                                     | .....                          |                          |                    |
|                                     | 3250                           | 2140.0                   | Middle Channel     |
|                                     | .....                          |                          |                    |
|                                     | 3387                           | 2167.4                   | Top Channel - 1    |
|                                     | 3388                           | 2167.6                   | Top Channel        |
|                                     | .....                          |                          |                    |
|                                     | 3400                           | 2170.0                   | Band edge          |

AHFIB Downlink Band edge WCDMA AWS Band Frequency Channels

**Multicarrier Multiband Test Case:**

In the AWS band: Three carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (UARFCN 3112: 2112.4 & UARFCN 3137: 2117.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (UARFCN 3388: 2167.6MHz) at the upper band edge. In the PCS band: Single WCDMA carrier at the middle channel (UARFCN 9800: 1960.0MHz).

### EUT Hardware

The EUT hardware used in testing on November 12-14, 2018.

| Company                      | Model | Description      | Part/Serial Number                         | FCC ID/IC Number                         |
|------------------------------|-------|------------------|--|--|
| Nokia Solutions and Networks | AHFIB | AirScale BTS RRH | Part#: 474216A.101<br>Serial#: K9174553644 | FCC ID: VBNAHFIB-01<br>IC ID: 661W-AHFIB |

### Enclosure

The EUT enclosure is made of heavy-duty aluminum.

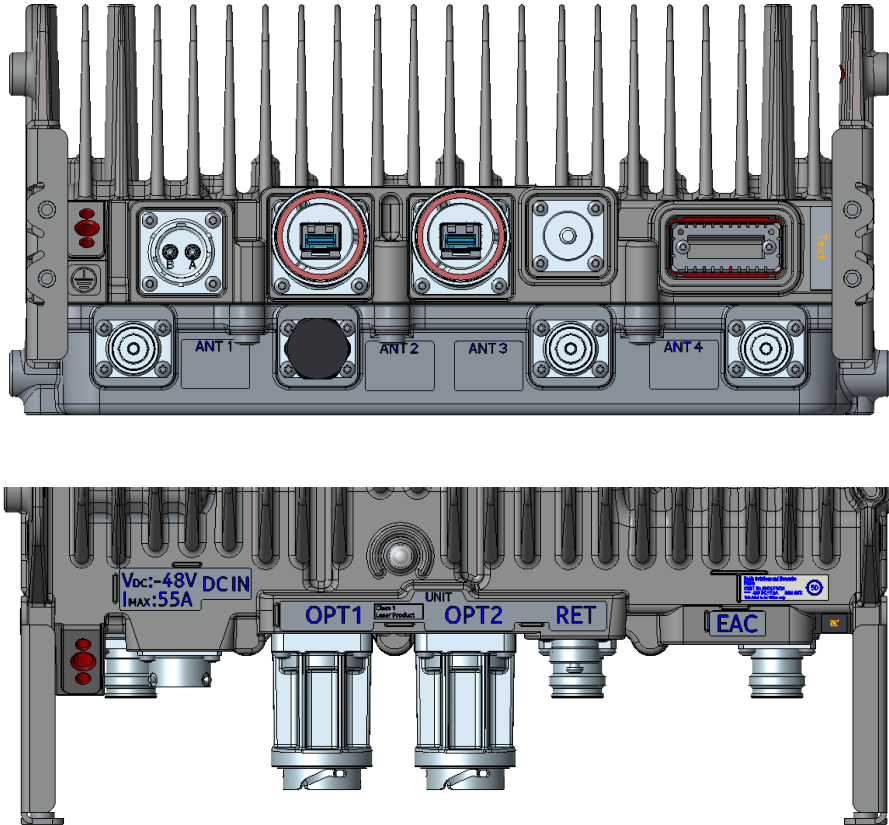
### Support Equipment:

| Company                      | Model          | Description            | Part/Serial Number                         | FCC ID/IC Number |
|------------------------------|----------------|------------------------|--|------------------|
| Nokia Solutions and Networks | AMIA           | Airscale System Module | Part#: 473098A.101<br>Serial#: RK164201509 | N/A              |
| HP                           | Pro Book 6470b | Laptop PC              | N/A  | N/A              |
| Dell                         | Studio XPS     | Instrumentation PC     | N/A  | N/A              |

### Auxillary Equipment:

| Company            | Description   | Part Number    | Serial Number |
|--------------------|---|----------------|---------------|
| Nokia              | FOUC 10GHz SFP Module<br>(Plugs into RRH Opt Ports) | 473842A.101    | KR16090020071 |
| RLC Electronics    | 2.4GHz High Pass Filter -2 Watt <sup>1</sup>        | F-100-3000-5-R | 0028          |
| Microwave Circuits | 1.4GHz Low Pass Filter -100 Watt <sup>1</sup>       | L13502G1       | 2454-01       |
| Weinschel          | Attenuator 20dB -150 Watt <sup>1</sup>              | 66-20-33-LIM   | BZ2075        |
| Weinschel          | Attenuator 40dB -250 Watt <sup>1</sup>              | 58-40-43-LIM   | TC909         |
| Weinschel          | Attenuator 10dB -250 Watt <sup>1</sup>              | 58-10-43-LIM   | TD446         |
| Weinschel          | Attenuator 3dB-100 Watt <sup>1</sup>                | 47-3-33        | CG5493        |
| Huber & Suhner     | RF Cable -0.5 meter <sup>1</sup>                    | Sucoflex 104   | 553624/4      |
| Huber & Suhner     | RF Cable -1 meter <sup>1</sup>                      | Sucoflex 106   | 297370        |

Note 1: Used only in antenna port RF conducted emission testing.

**AHFIB Connector Layout:**

**EUT External Interfaces:**

| Name  | Qty | Connector Type  | Purpose (and Description)                      |
|-------|-----|---|--|
| DC In | 1   | Quick Disconnect  | 2-pole Power Circular Connector                |
| GND   | 1   | Screw lug (2xM5/1xM8)                                       | Ground   |
| ANT   | 4   | 4.3-10  | RF signal for Transmitter/Receiver (50 Ohm)    |
| Unit  | 1   | LED   | Unit Status LED                                |
| EAC   | 1   | MDR26   | External Alarm Interface (4 alarms)            |
| OPT   | 2   | SFP+ cage   | Optical CPRI Interface up to 10 Gps.           |
| RET   | 1   | 8-pin circular connector conforming to IEC 60130-9 – Ed.3.0 | AISG 2.0 to external devices                   |
| Fan   | 1   | Molex Microfit  | Power for RRH Fan. Located on the side of RRH. |

### EUT Interface Ports

The I/O cabling configuration during testing was as follows:

| Cable                  | Type    | Shield | Length | Used in Test | Quantity | Termination      |
|------------------------|---------|--------|--------|--------------|----------|------------------|
| Power Input            | Power   | No     | ~ 3 m  | Yes          | 1        | Power Supply     |
| Earth                  | Earth   | No     | ~ 1 m  | Yes          | 1        | Lab earth ground |
| Antenna                | RF      | Yes    | ~ 3 m  | Yes          | 4        | 50Ω Loads        |
| External Alarm         | Signal  | Yes    | ~ 3 m  | Yes          | 1        | Un-terminated    |
| Remote Electrical Tilt | Signal  | Yes    | ~ 3 m  | Yes          | 1        | Un-terminated    |
| Multimode Optical      | Optical | No     | >6 m   | Yes          | 1        | System Module    |

### EUT Operation

During testing, the EUT was transmitting continuously with 100% duty-cycle at full power on all chains.

### EUT Software

The laptop PC connects to the System Module over the LMP (Ethernet) port. The system module controls the RRH via the optical interface. The laptop is used for changing configuration settings, monitoring tests and controlling the BTS. The following software versions are used for the testing:

- (1) RRH Unit Software: FRM58.08.R24H
- (2) System Module Software:  
SBTS18SP\_ENB\_2000\_000771\_000000\_release\_BTSSM\_downloadable\_A53

### Modifications

No modifications were made to the EUT during testing.



## TESTING

### General Information

Antenna port measurements were taken with NTS personnel (Christian Booker) at Nokia premises located at 6000 Connection Drive; Irving, Texas 75309.

Radiated emissions and frequency accuracy/stability measurements were taken at NTS Plano branch located at 1701 E Plano Pkwy #150 Plano, TX 75074 during the original certification effort (See NTS Test Report Number PR072254 Revision 1 dated March 16, 2018 for details).

### Measurement Procedures

The RMS average output power, peak power output, emission bandwidth, conducted spurious, and conducted band edge measurements were performed with a spectrum analyzer. The EUT was operated at maximum RF output power for all tests (unless otherwise noted). While measuring one transmit chain, the other one was terminated with termination blocks. All measurements were corrected for the insertion loss of the RF network (attenuators, filters, and cables) inserted between the RF port of the EUT and the spectrum analyzer. Block diagrams and photographs of the test setups are provided below.

The 26dB emission bandwidth was measured in accordance with section 4 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.4. The 99% occupied bandwidth was measured in accordance with section 6.7 of RSS-Gen Issue 5. For both measurements, an occupied bandwidth built-in function in the spectrum analyzer was used and Keysight Benchvue Software was used to capture the spectrum analyzer screenshots. Spectrum analyzer settings are shown on their corresponding plots in test results section.

The emissions at the band edges were captured with Keysight Benchvue Software with settings described in the corresponding sections of the FCC and IC regulatory requirements. Spectrum analyzer settings are shown on their corresponding plots in test results section.

Average output power measurements were performed in accordance with sections 5.2 of FCC KDB 971168 D01v03r01 and ANSI C63.26 and the screenshots were captured using Keysight Benchvue Software. Peak power measurements were performed as described in section 5.1 of KDB 971168 D01v03r01 and ANSI C63.26-2015 section 5.2.3 and the screenshots were captured using Keysight Benchvue Software. The peak to average power ratio (PAPR) has been calculated as described in section 5.7 of KDB971168 D01v03r01 and ANSI C63.26-2015 section 5.2.6. Analyzer settings are shown on their corresponding plots in the test results section.

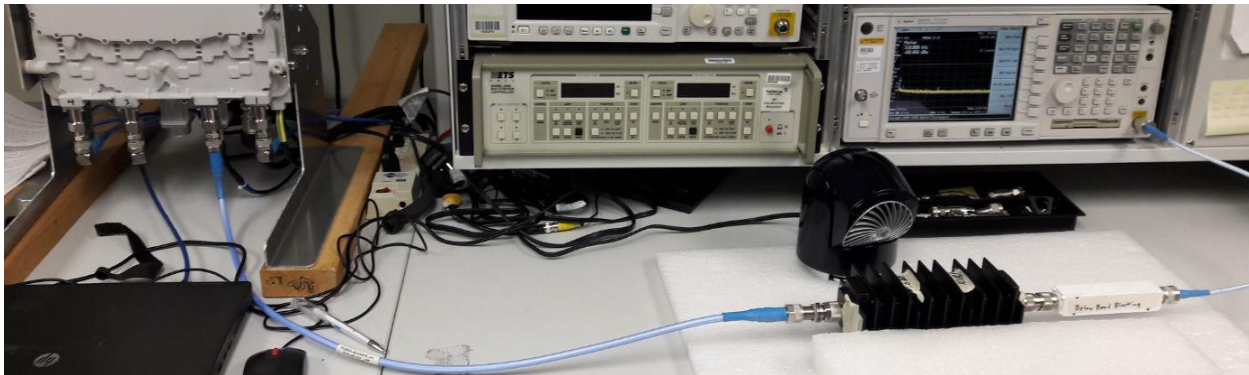
Conducted spurious emissions were captured with Keysight Benchvue Software across the 9kHz-22GHz frequency span. A low pass filter was used to reduce measurement instrumentation noise floor for the frequency ranges below 20MHz. A high pass filter was used to reduce measurement instrumentation noise floor for the frequency ranges above 6GHz. The total measurement RF path loss of the test setup (attenuators, filters and test cables) were accounted for by the spectrum analyzer reference level offset. Spectrum analyzer settings are described in the corresponding test result section.

### Antenna Port Conducted RF Measurement Test Setup Diagrams

The following setups were used in the AHFIB RF conducted emissions testing. The photographs of the test setups are also provided.



Setup for 9kHz to 150kHz and 150kHz to 20MHz Measurements



Photograph of 9kHz to 150kHz and 150kHz to 20MHz Test Setup



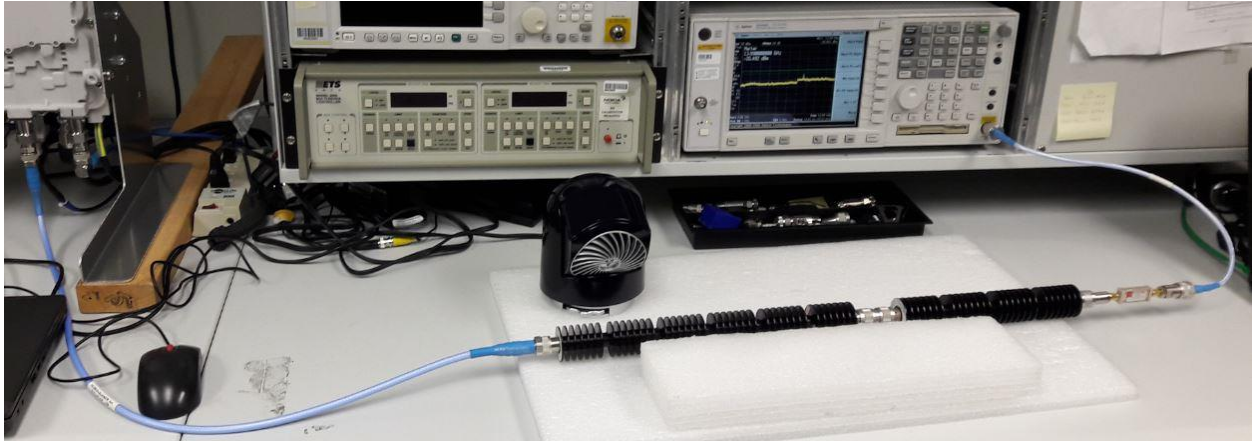
Setup for 20MHz to 3GHz and 3GHz to 6GHz Measurements



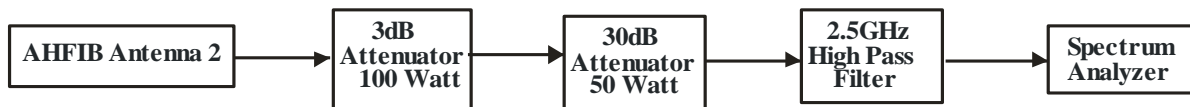
Photograph of 20MHz to 3GHz and 3GHz to 6GHz Test Setup



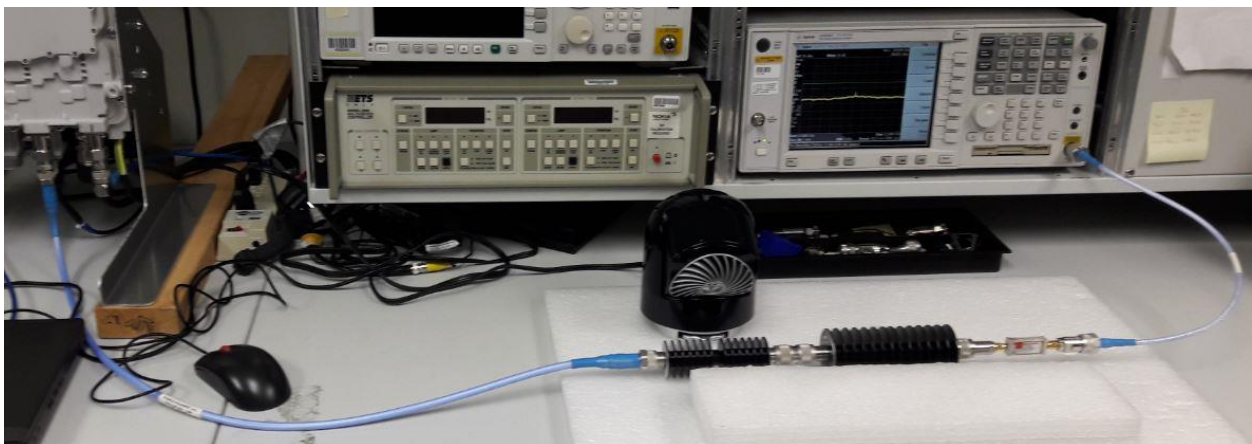
Setup for 6GHz to 18GHz Measurements



Photograph of for 6GHz to 18GHz Test Setup



Setup for 18GHz to 22GHz Measurements



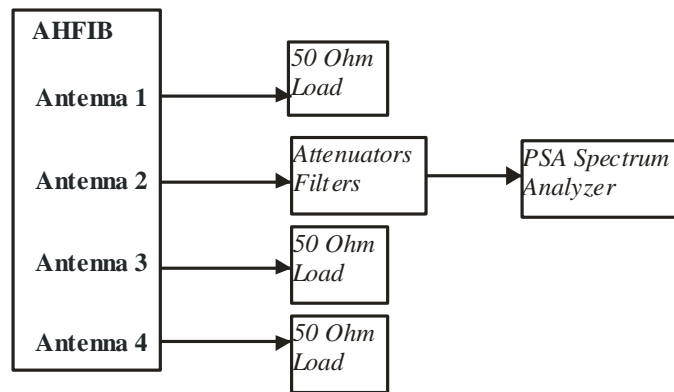
Photograph of for 18GHz to 22GHz Test Setup

**Test Measurement Equipment**

| <b>Nokia Equipment #</b>   | <b>Description</b>    | <b>Manufacturer</b> | <b>Model</b> | <b>Calibration Duration</b> | <b>Calibration Due Date</b> |
|----------------------------|-----------------------|---------------------|--------------|-----------------------------|-----------------------------|
| 120194 <sup>1</sup>        | PSA Spectrum Analyzer | Agilent             | E4440A       | 12 Months                   | 10/17/2019                  |
| NM06345 <sup>1</sup>       | ENA Network Analyzer  | Keysight            | E5063A       | 12 Months                   | 11/20/2018                  |
| NM04509 <sup>1</sup>       | Network Analyzer      | Rohde & Schwarz     | ZVL 3        | 12 Months                   | 2/03/2019                   |
| NM06374 <sup>1</sup>       | MXG Analog Signal Gen | Keysight            | N5183B       | 36 Months                   | 02/04/2021                  |
| Note 1: Customer equipment |                       |                     |              |                             |                             |

**APPENDIX A: ANTENNA PORT GSM/EDGE TEST DATA FOR THE PCS BAND**

All conducted RF measurements in this section were made at AHFIB antenna port 2. The testing was performed on the same hardware (EUT) as the original certification test. The same EUT RF port (Ant 2) determined in the original certification testing to be the highest power port was used for all testing in this effort. All testing in this section was performed with GSM/EDGE modulation types. The test setup used is provided below.



Test Setup Used for AHFIB Conducted RF Measurements

**RF Output Power**

RF output power has been measured in both Peak and RMS Average terms at AHFIB Antenna Port 2 at the bottom, middle and top frequency channels for GSM/EDGE modulations. RMS Average power was measured as described in section 5.2 of KDB 971168 D01v03r01 and ANSI C63.26-2015 sections 5.2.4.3. Peak power was measured as described in section 5.1 of KDB 971168 D01v03r01 and ANSI C63.26-2015 section 5.2.3.3. The peak to average power ratio (PAPR) has been calculated as described in section 5.7 of KDB971168 D01v03r01 and ANSI C63.26-2015 section 5.2.6. All results are presented in tabular form below. Measurements were rounded off to the nearest tenth. The highest values are highlighted.

| Modulation | Frequency _ Channel         | Peak (dBm)  | Average (dBm) | PAPR (dB)  |
|------------|-----------------------------|-------------|---------------|------------|
| GMSK       | 1930.2MHz _ Bottom Channel* | 36.1        | 35.5          | <b>0.6</b> |
|            | 1930.4MHz _ BC+1            | 46.1        | 45.5          | <b>0.6</b> |
|            | 1960.0MHz _ Middle Channel  | 46.2        | 45.7          | 0.5        |
|            | 1989.6MHz _ TC-1            | <b>46.3</b> | <b>45.9</b>   | 0.4        |
|            | 1989.8MHz _ Top Channel*    | 36.3        | 35.7          | <b>0.6</b> |
| 8PSK       | 1930.2MHz _ Bottom Channel* | 39.1        | 35.6          | <b>3.5</b> |
|            | 1930.4MHz _ BC+1            | 49.0        | 45.8          | 3.2        |
|            | 1960.0MHz _ Middle Channel  | 49.2        | <b>45.9</b>   | 3.3        |
|            | 1989.6MHz _ TC-1            | <b>49.3</b> | <b>45.9</b>   | 3.4        |
|            | 1989.8MHz _ Top Channel*    | 39.3        | 36.0          | 3.3        |

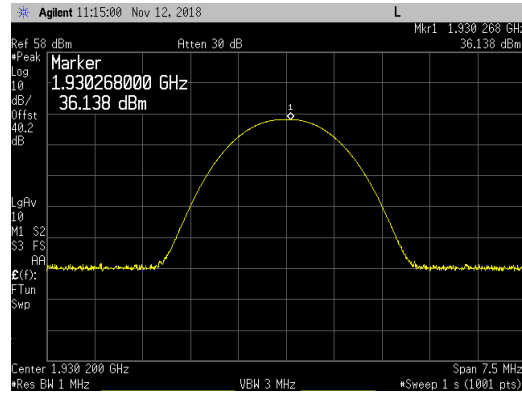
\*Reduced Power Channels

The power levels at the bottom and top channels had to be reduced by 10 dB to meet the band edge emission requirements. The next channel from the band edge (i.e.: BC+1 and TC-1) met the band edge emission requirements with the RRH operating at maximum output power.

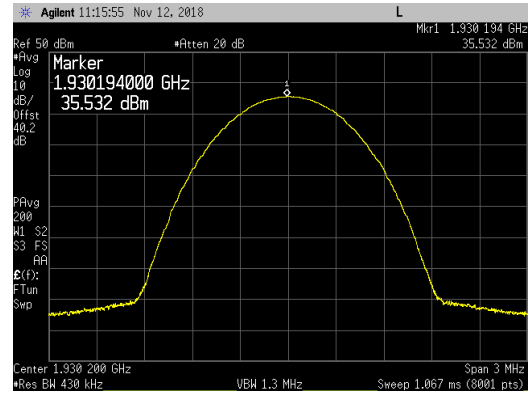
All measurement results are provided in the following pages. The total measurement RF path loss of the test setup (attenuator and test cables) was 40.2 dB and is accounted for by the spectrum analyzer reference level offset.

**Power Plots at AHFIB Antenna Port 2 for GMSK Modulation**

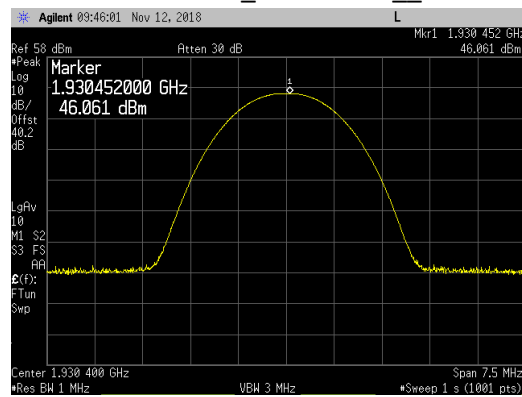
**Bottom Channel\_1930.2MHz\_Peak**



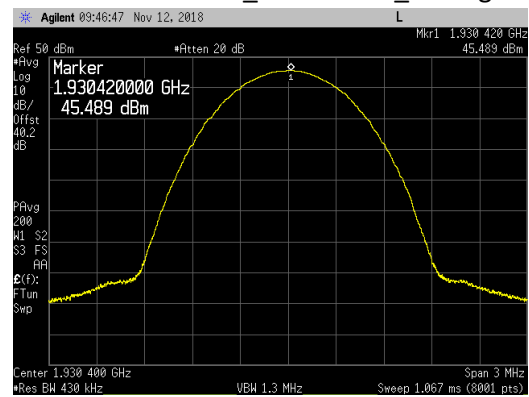
**Bottom Channel\_1930.2MHz\_Average**



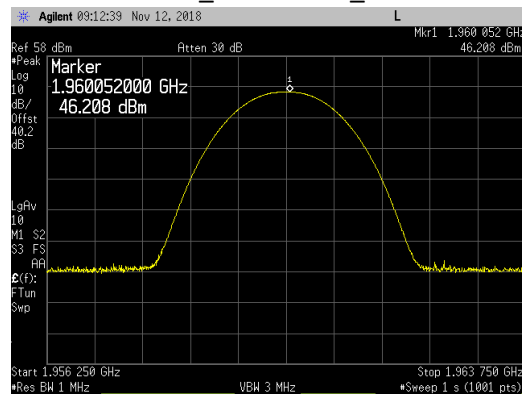
**Bottom Channel +1\_1930.4MHz\_Peak**



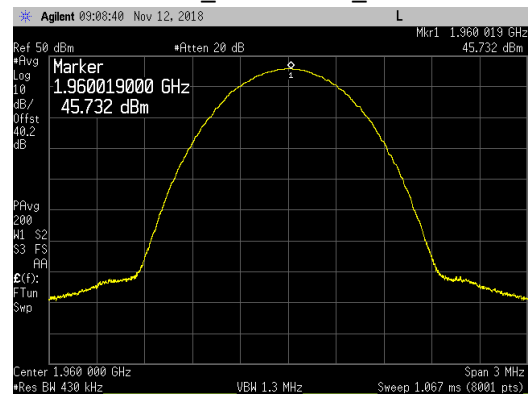
**Bottom Channel +1\_1930.4MHz\_Average**



**Middle Channel\_1960.0MHz\_Peak**



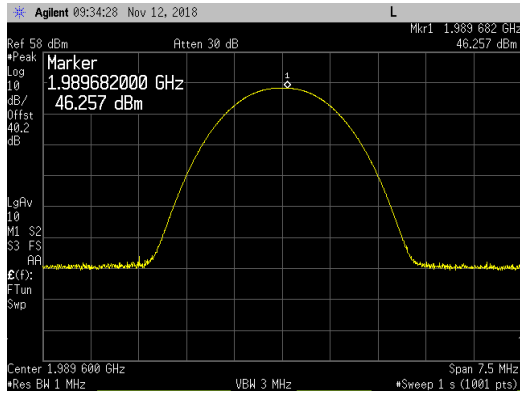
**Middle Channel\_1960.0MHz\_Ave**



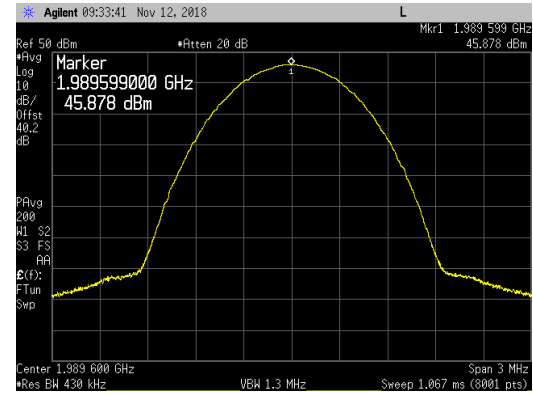


**Power Plots at AHFIB Antenna Port 2 for GMSK Modulation continued**

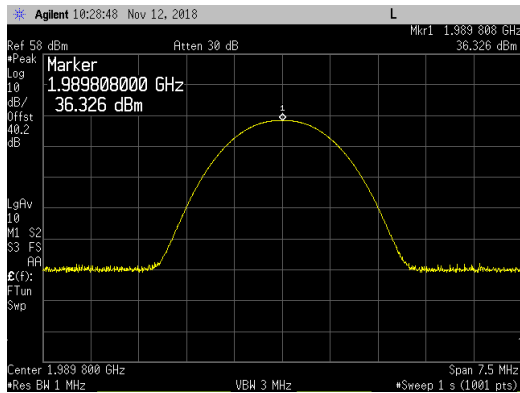
**Top Channel -1\_1989.6MHz\_Peak**



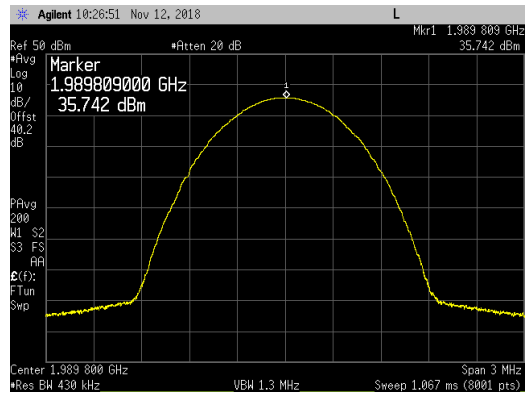
**Top Channel -1\_1989.6MHz\_Average**



**Top Channel\_1989.8MHz\_Peak**



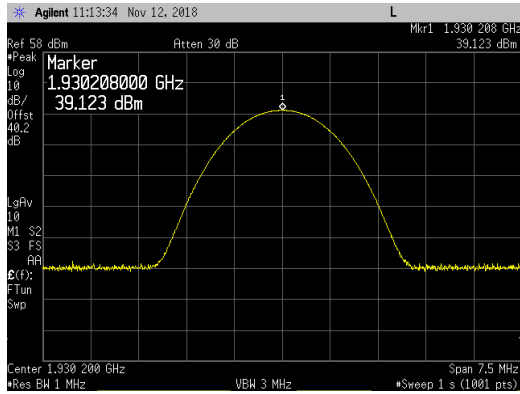
**Top Channel\_1989.8MHz\_Average**



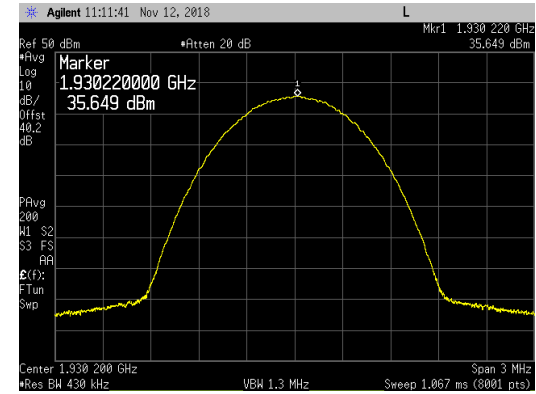


**Power Plots at AHFIB Antenna Port 2 for 8PSK Modulation**

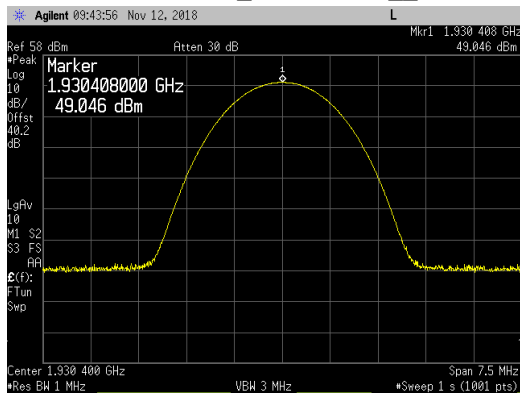
**Bottom Channel\_1930.2MHz\_Peak**



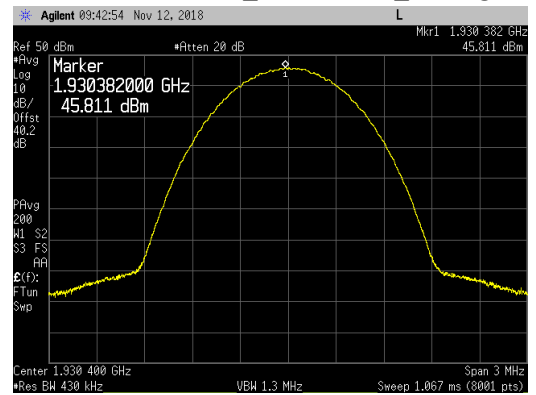
**Bottom Channel\_1930.2MHz\_Average**



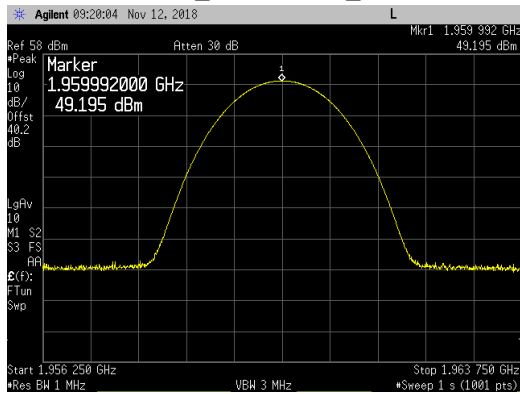
**Bottom Channel +1\_1930.4MHz\_Peak**



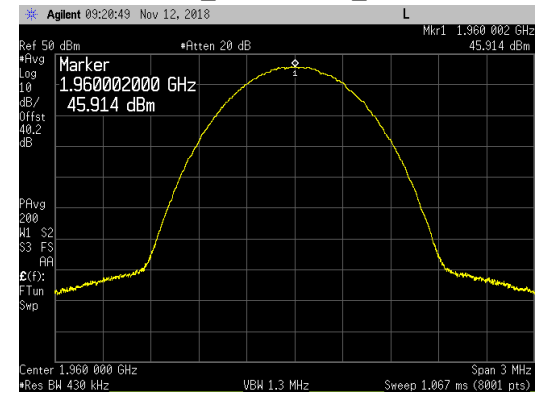
**Bottom Channel +1\_1930.4MHz\_Average**



**Middle Channel\_1960.0MHz\_Peak**

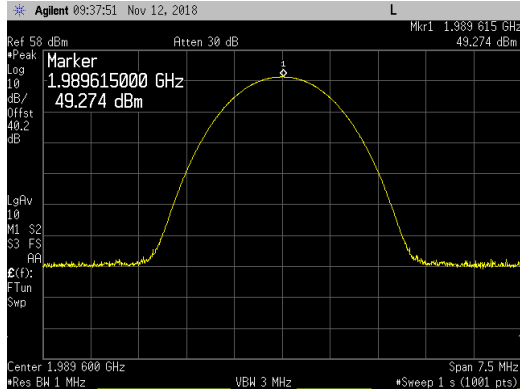


**Middle Channel\_1960.0MHz\_Ave**

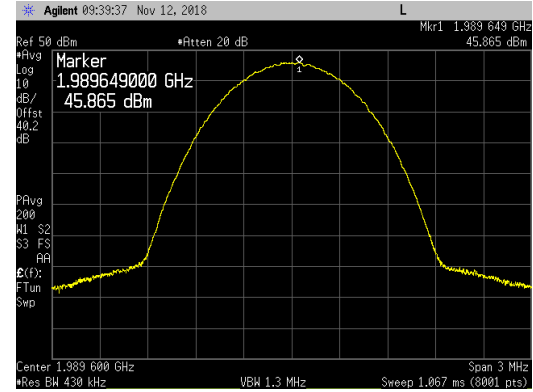


**Power Plots at AHFIB Antenna Port 2 for 8PSK Modulation continued**

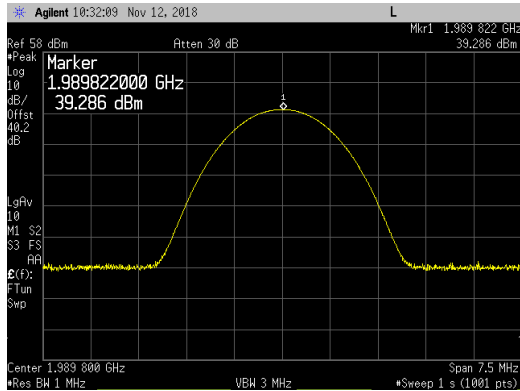
**Top Channel -1\_1989.6MHz\_Peak**



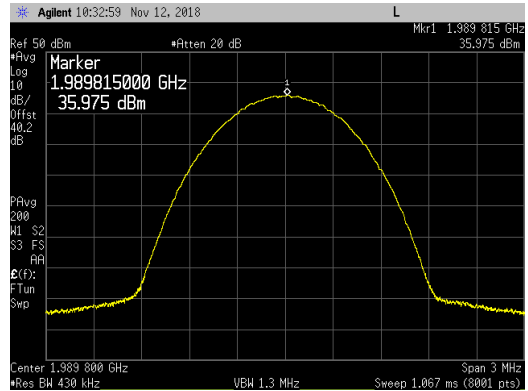
**Top Channel -1\_1989.6MHz\_Average**



**Top Channel\_1989.8MHz\_Peak**



**Top Channel\_1989.8MHz\_Average**



**Emission Bandwidth (26 dB down and 99%)**

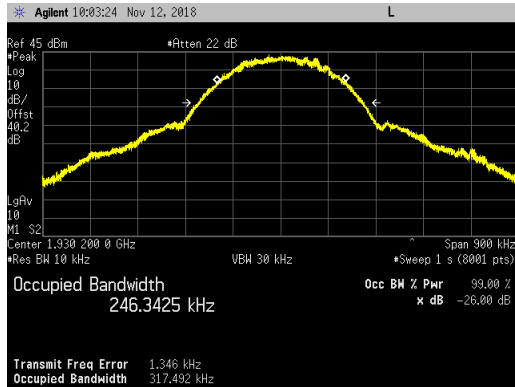
Emission bandwidth measurements were made at antenna port 2 on the bottom, middle and top channels. The AHFIB was operated at maximum RF output power for GSM/EDGE modulations. The 26dB emission bandwidth was measured in accordance with section 4 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.4. The 99% occupied bandwidth was measured in accordance with section 6.7 of RSS-Gen Issue 5. For both measurements, an occupied bandwidth built-in function in the spectrum analyzer was used. The results are provided in the following table. The largest emission bandwidth is highlighted. Measurements were rounded off to the nearest kHz.

| Modulation | Frequency _ Channel      | Emission Bandwidth (kHz) |            |
|------------|--------------------------|--------------------------|------------|
|            |                          | 26dB                     | 99%        |
| GMSK       | 1930.2MHz_Bottom Channel | 317                      | 246        |
|            | 1960.0MHz_Middle Channel | <b>323</b>               | <b>247</b> |
|            | 1989.8MHz_Top Channel    | 320                      | <b>247</b> |
| 8PSK       | 1930.2MHz_Bottom Channel | 309                      | <b>243</b> |
|            | 1960.0MHz_Middle Channel | 309                      | <b>243</b> |
|            | 1989.8MHz_Top Channel    | <b>311</b>               | <b>243</b> |

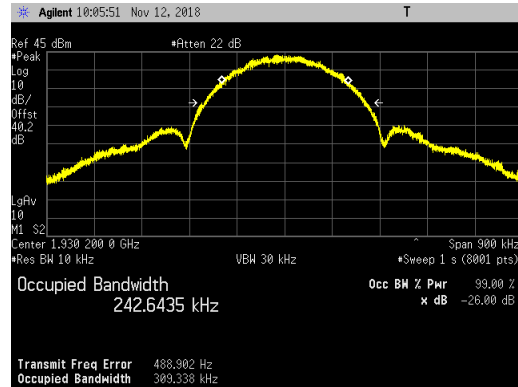
Emission bandwidth measurement data are provided in the following pages.

**GSM/EDGE Emission Bandwidth Plots at AHFIB Antenna Port 2**

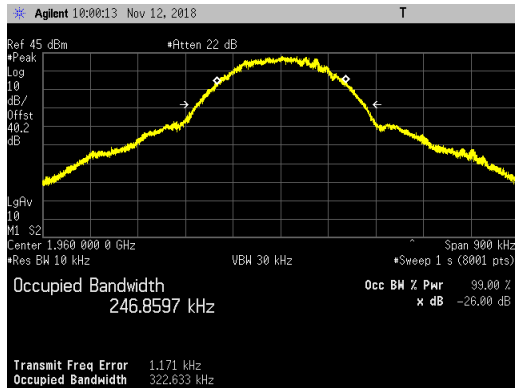
**Bottom Channel\_1930.2MHz\_GMSK Modulation**



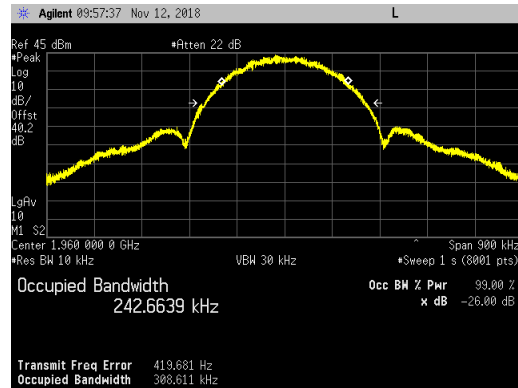
**Bottom Channel\_1930.2MHz\_8PSK Modulation**



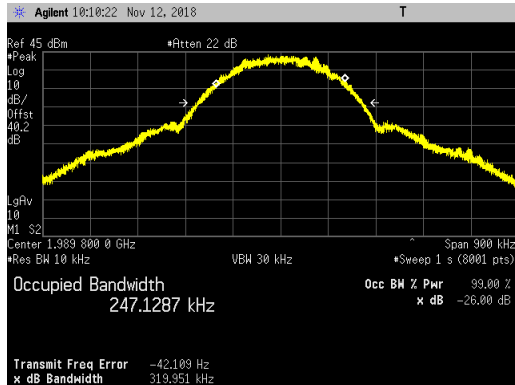
**Middle Channel\_1960.0MHz\_GMSK Modulation**



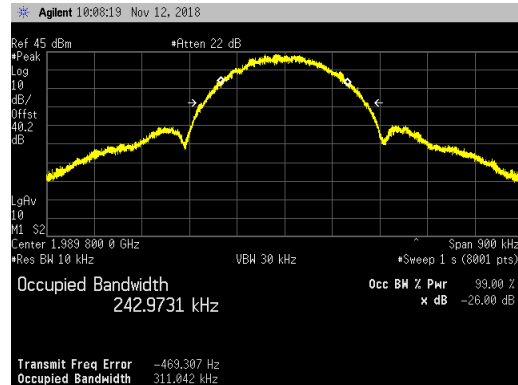
**Middle Channel\_1960.0MHz\_8PSK Modulation**



**Top Channel\_1989.8MHz\_GMSK Modulation**



**Top Channel\_1989.8MHz\_8PSK Modulation**



### **Antenna Port Conducted Band Edge**

Conducted band edge measurements were made at AHFIB antenna port 2 at the upper and lower band edges. The AHFIB was operated at the band edge frequencies with GSM/EDGE modulation types.

The AHFIB single carrier output power was reduced by 10 dB at the bottom (1930.2MHz) and top (1989.8MHz) RF channels to pass the band edge emission requirements. The AHFIB single carrier at maximum output power passed band edge emissions requirements at one RF channel inside the bottom and top RF channels (i.e.: BC+1\_1930.4MHz and TC-1\_1989.6MHz).

Two multicarrier test cases based upon KDB 971168 D03v01 using three carriers (at maximum power) per antenna port was performed. The first multicarrier test case is with two carriers (with minimum spacing between carrier frequencies) at the lower band edge (i.e.: 1930.2 & 1930.6MHz) and a third carrier with maximum spacing between the other two carrier frequencies (1967.4MHz). The second multicarrier test case is with two carriers (with minimum spacing between carrier frequencies) at upper band edge (i.e.: 1989.4 & 1989.8MHz) and a third carrier with maximum spacing between the other two carrier frequencies (1952.6MHz). The multicarrier cases at maximum output port power passed band edge emissions requirements at one RF channel inside the bottom and top RF channels (i.e.: BC+1\_1930.4MHz and TC-1\_1989.6MHz). The power was reduced by 6dB to pass the band edge requirements at the bottom and top channels.

The power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm as specified in section 24.238(a) and RSS 133 6.5(i). The GSM/EDGE carriers are not MIMO.

Measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces. In the 1MHz bands outside and adjacent to the frequency block, a resolution bandwidth of 1% of the measured emission bandwidth (3.3kHz) per 24.238(b) and RSS 133 6.5(i) was used. In the 1 to 2MHz frequency range outside the band edge (i.e.: 1928 to 1929MHz and 1996 to 1997MHz bands) the RBW was set to 1% of the measured emission bandwidth (3.3kHz) and the power integrated over 1MHz. In the 2MHz to 22MHz frequency range outside the band edge (i.e.: 1908 to 1928MHz and 1997 to 2017MHz bands) a 1MHz RBW and 3MHz VBW was used. The results are summarized in the following table. The highest (worst case) emissions from the measurement data are provided.

| Band 2 Carrier Frequency<br>Modulation Type and Carrier Power Level  | Port 2 (dBm) |         |
|--|--------------|---------|
|  | Lower        | Upper   |
| Single Carrier at Bottom Channel (1930.2MHz)/Top Channel (1989.8MHz)<br>GMSK and Reduced Power (Maximum Power -10dB)   | -14.402      | -14.586 |
| Single Carrier at Bottom Channel (1930.2MHz)/Top Channel (1989.8MHz)<br>8PSK and Reduced Power (Maximum Power -10dB)   | -18.109      | -18.225 |
| Single Carrier at BC+1 (1930.4MHz)/TC-1 (1989.6MHz)<br>GMSK and Maximum Power (40 Watts)   | -25.899      | -26.87  |
| Single Carrier at BC+1 (1930.4MHz)/TC-1 (1989.6MHz)<br>8PSK and Maximum Power (40 Watts)   | -26.206      | -25.305 |
| Three Carriers at BCs (1930.2 and 1930.6MHz) and at Max Spacing (1967.4MHz)/ Three<br>Carriers at TCs (1989.4 and 1989.8MHz) and at Max Spacing (1952.6MHz)<br>GMSK and Reduced Power            | -16.102      | -15.830 |
| Three Carriers at BCs (1930.2 and 1930.6MHz) and at Max Spacing (1967.4MHz)/ Three<br>Carriers at TCs (1989.4 and 1989.8MHz) and at Max Spacing (1952.6MHz) 8PSK and<br>Reduced Power            | -18.629      | -18.710 |
| Three Carriers at BCs (1930.4 and 1930.8MHz) and at Max Spacing (1967.4MHz)/ Three<br>Carriers at TCs (1989.2 and 1989.6MHz) and at Max Spacing (1952.6MHz)<br>GMSK and Maximum Power (40 Watts) | -24.642      | -24.357 |
| Three Carriers at BCs (1930.4 and 1930.8MHz) and at Max Spacing (1967.4MHz)/ Three<br>Carriers at TCs (1989.2 and 1989.6MHz) and at Max Spacing (1952.6MHz) 8PSK and<br>Maximum Power (40 Watts) | -25.291      | -25.903 |

The reduced power level was 10dB down from maximum power level (~36dBm) for the single carrier as shown in the RF output power section of this report.

The total measurement RF path loss of the test setup (attenuator and test cables) was 40.2 dB and is accounted for by the spectrum analyzer reference level offset. The display line on the plots reflects the required limit.

Conducted band edge measurements are provided in the following pages.

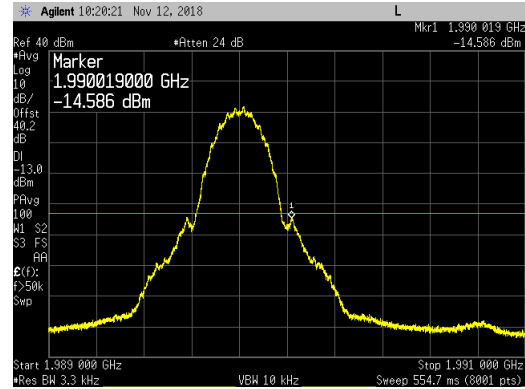
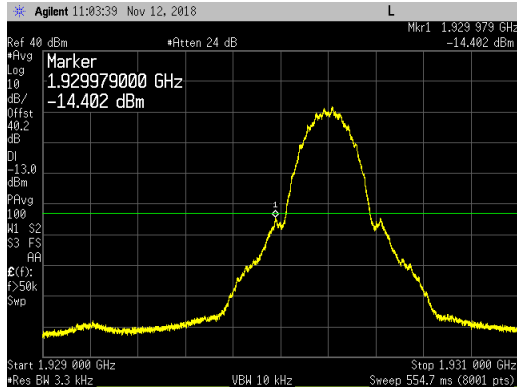
**Single Carrier at Reduced Power -Lower and Upper Band Edge Plots:**

GSMK Carrier at Bottom Channel (1930.2MHz)

GSMK Carrier at Top Channel (1989.8MHz)

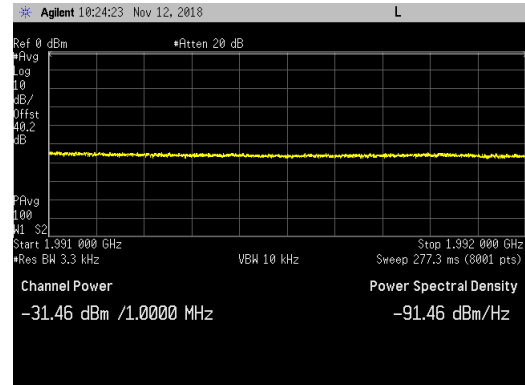
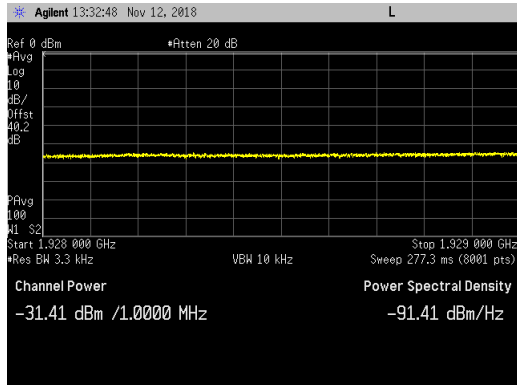
Port 2\_LBE\_1929 to 1931MHz

Port 2\_UBE\_1989 to 1991MHz



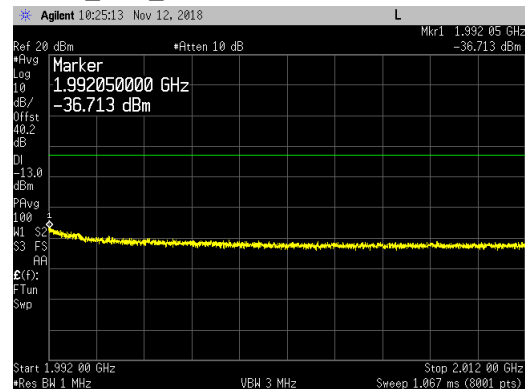
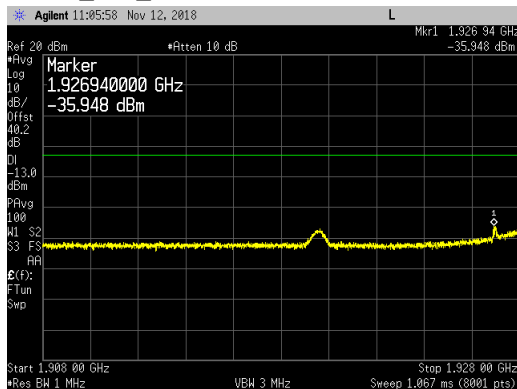
Port 2\_LBE\_1928 to 1929MHz

Port 2\_UBE\_1991 to 1992MHz



Port 2\_LBE\_1908 to 1928MHz

Port 2\_UBE\_1992 to 2012MHz



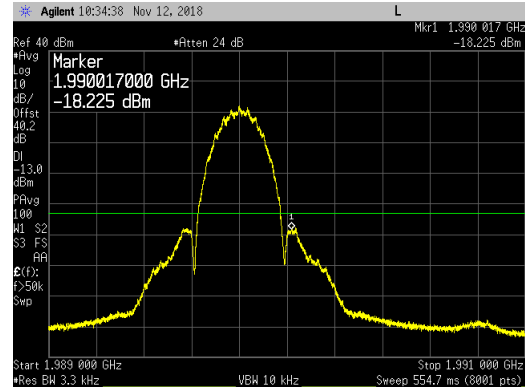
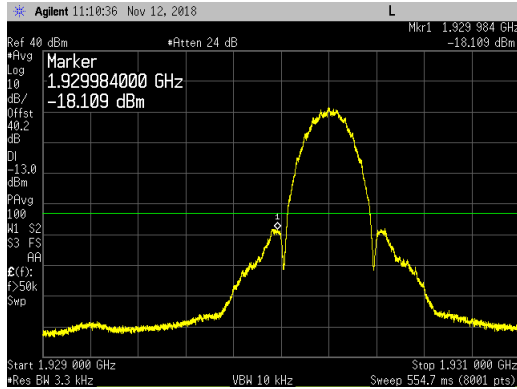
### Single Carrier at Reduced Power -Lower and Upper Band Edge Plots

8PSK Carrier at Bottom Channel (1930.2MHz)

8PSK Carrier at Top Channel (1989.8MHz)

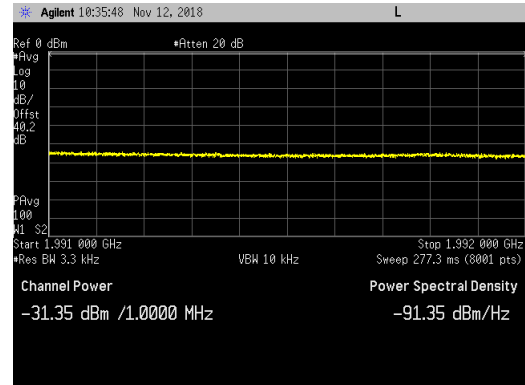
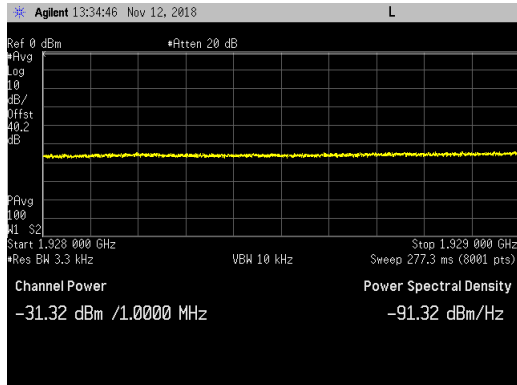
Port 2\_LBE\_1929 to 1931MHz

Port 2\_UBE\_1989 to 1991MHz



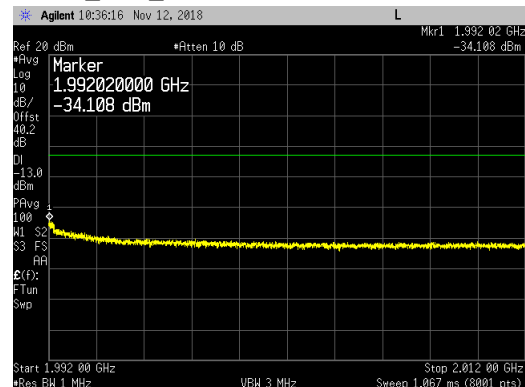
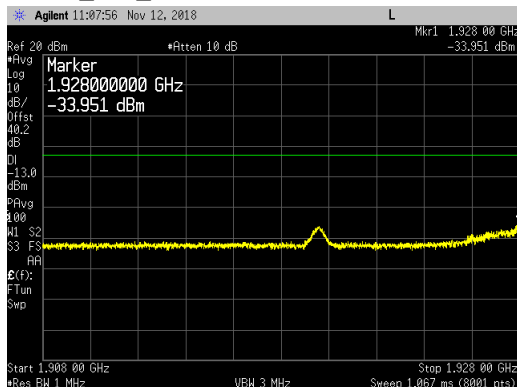
Port 2\_LBE\_1928 to 1929MHz

Port 2\_UBE\_1991 to 1992MHz



Port 2\_LBE\_1908 to 1928MHz

Port 2\_UBE\_1992 to 2012MHz





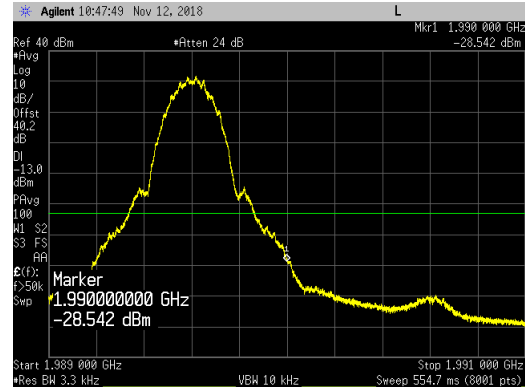
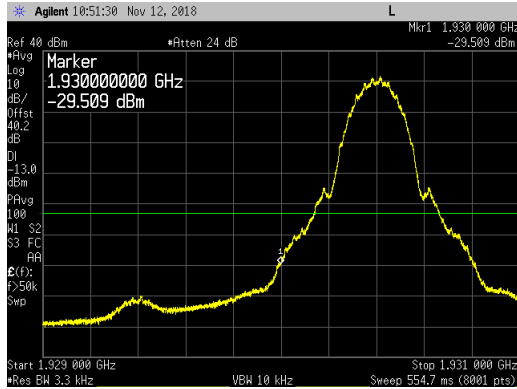
Single Carrier at Maximum Power -Lower and Upper Band Edge Plots

GMSK Carrier at BC+1 (1930.4MHz)

GMSK Carrier at TC-1 (1989.6MHz)

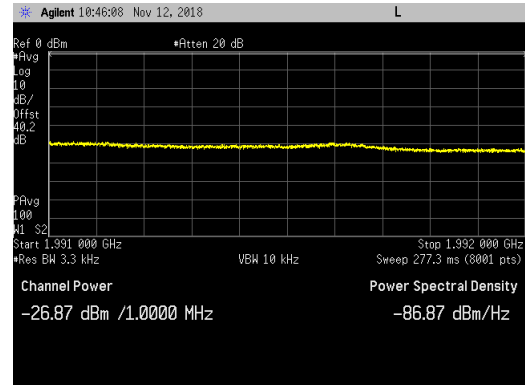
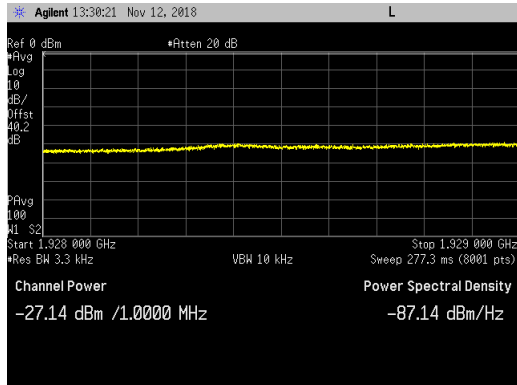
Port 2\_LBE\_1929 to 1931MHz

Port 2\_UBE\_1989 to 1991MHz



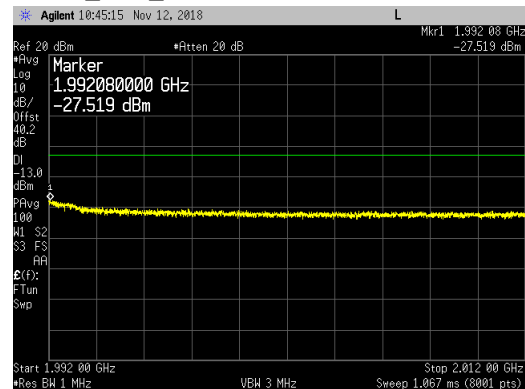
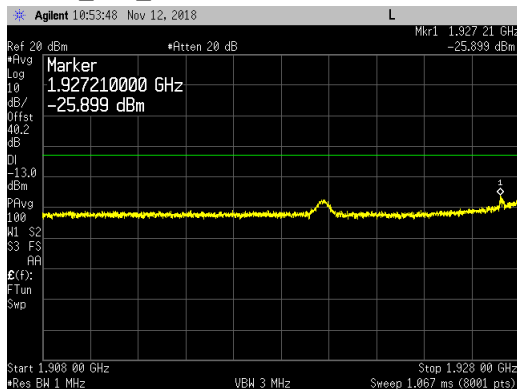
Port 2\_LBE\_1928 to 1929MHz

Port 2\_UBE\_1991 to 1992MHz



Port 2\_LBE\_1908 to 1928MHz

Port 2\_UBE\_1992 to 2012MHz



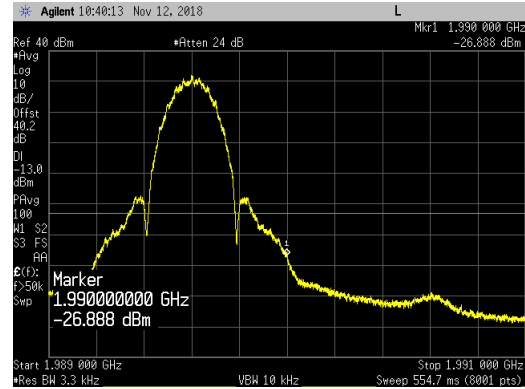
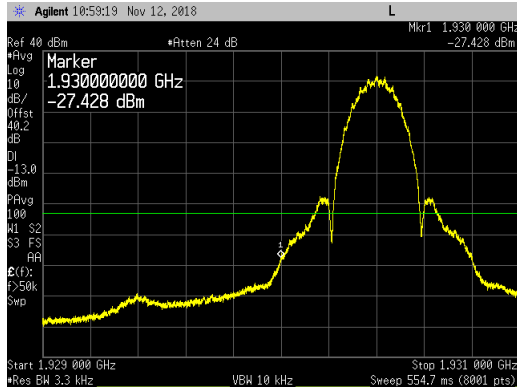
**Single Carrier at Maximum Power -Lower and Upper Band Edge Plots:**

8PSK Carrier at BC+1 (1930.4MHz)

8PSK Carrier at TC-1 (1989.6MHz)

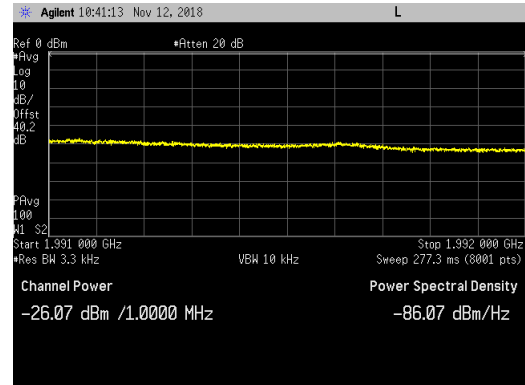
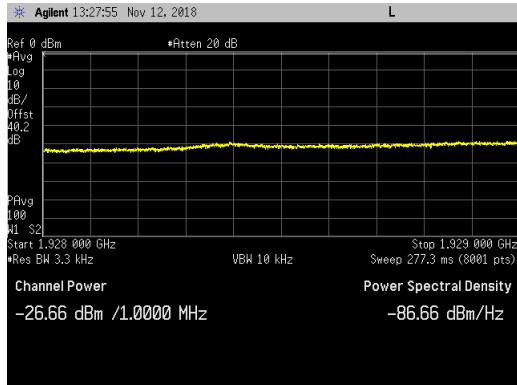
Port 2\_LBE\_1929 to 1931MHz

Port 2\_UBE\_1989 to 1991MHz



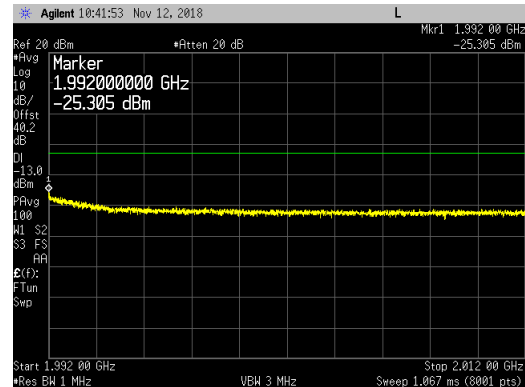
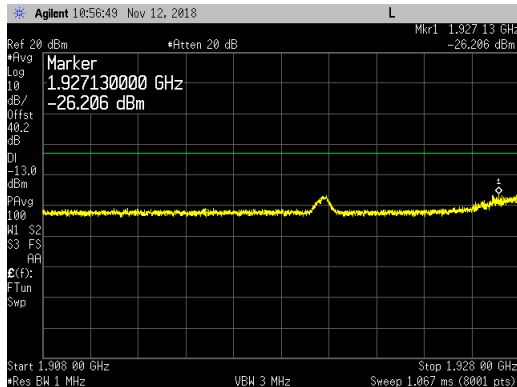
Port 2\_LBE\_1928 to 1929MHz

Port 2\_UBE\_1991 to 1992MHz



Port 2\_LBE\_1908 to 1928MHz

Port 2\_UBE\_1992 to 2012MHz



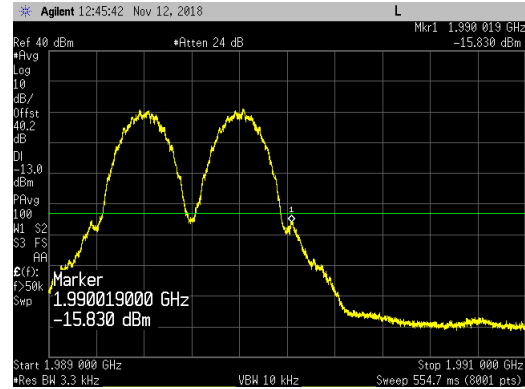
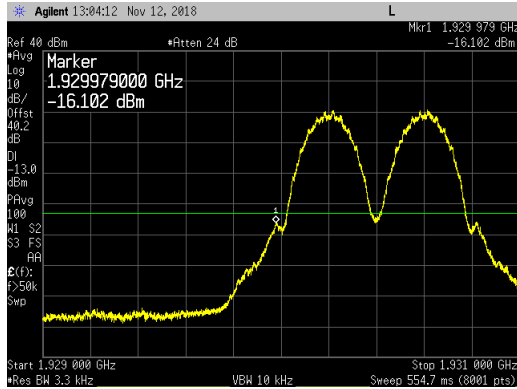
**Three Carriers at Reduced Power -Lower and Upper Band Edge Plots:**

GMSK Carriers at 1930.2, 1930.6 & 1967.4MHz

GMSK Carriers at 1989.4, 1989.8 & 1952.6MHz

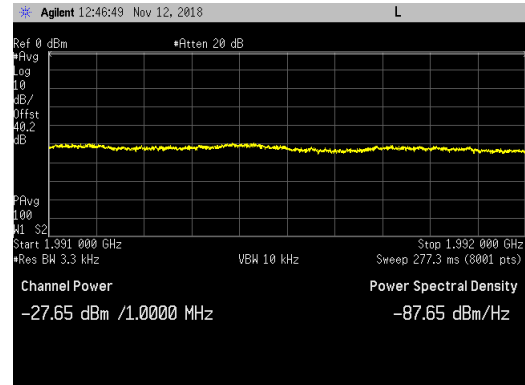
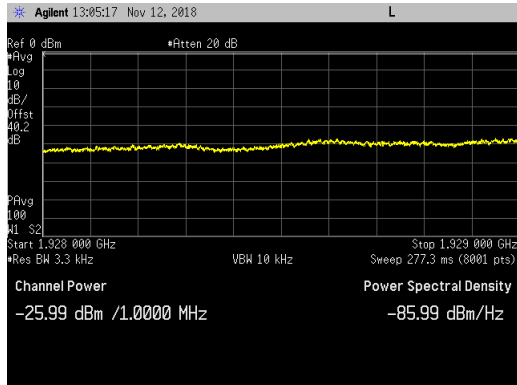
Port 2\_LBE\_1929 to 1931MHz

Port 2\_UBE\_1989 to 1991MHz



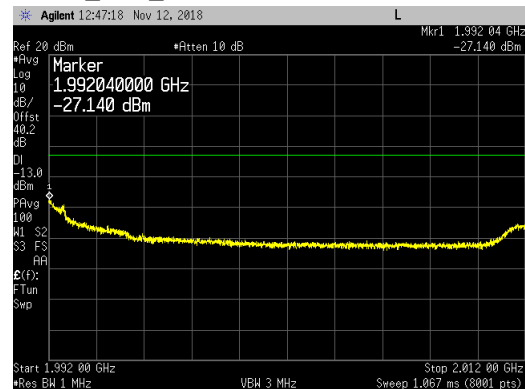
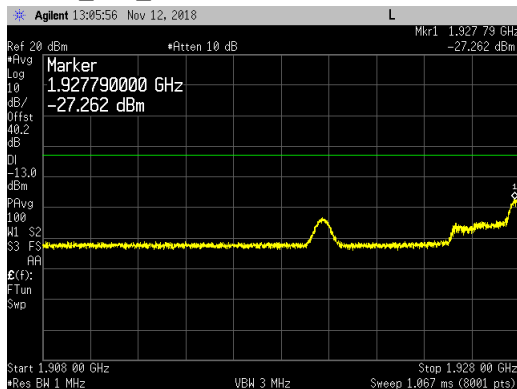
Port 2\_LBE\_1928 to 1929MHz

Port 2\_UBE\_1991 to 1992MHz



Port 2\_LBE\_1908 to 1928MHz

Port 2\_UBE\_1992 to 2012MHz



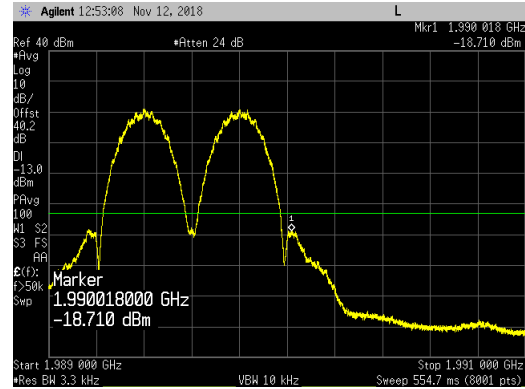
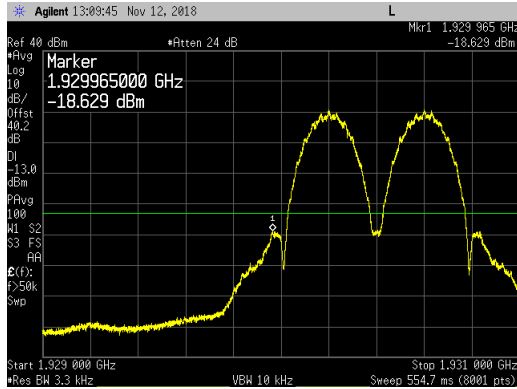
**Three Carriers at Reduced Power -Lower and Upper Band Edge Plots:**

8PSK Carriers at 1930.2, 1930.6 & 1967.4MHz

8PSK Carriers at 1989.4, 1989.8 & 1952.6MHz

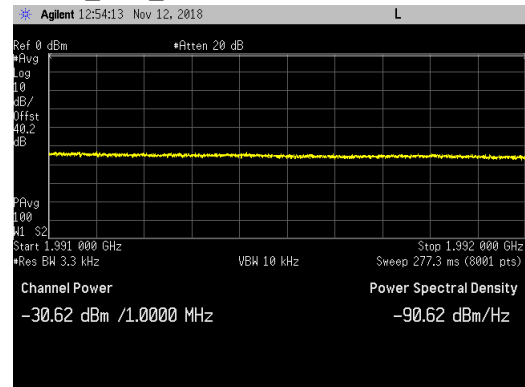
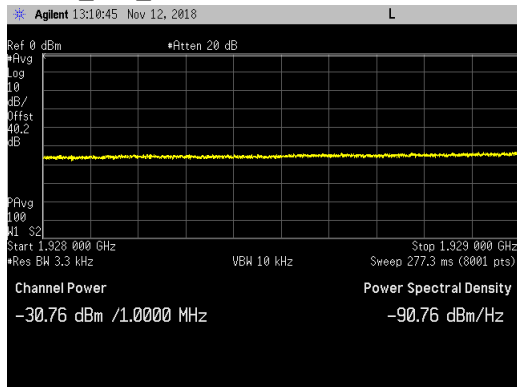
Port 2\_LBE\_1929 to 1931MHz

Port 2\_UBE\_1989 to 1991MHz



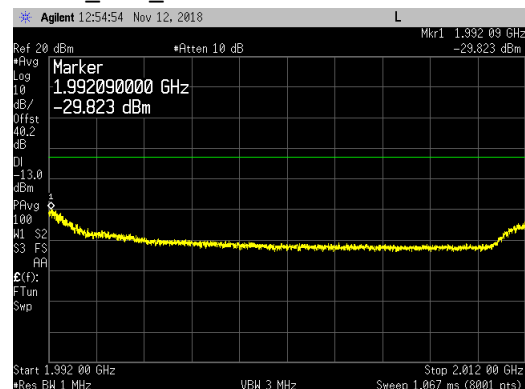
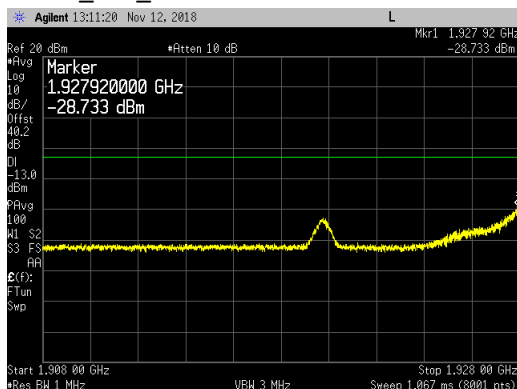
Port 2\_LBE\_1928 to 1929MHz

Port 2\_UBE\_1991 to 1992MHz



Port 2\_LBE\_1908 to 1928MHz

Port 2\_UBE\_1992 to 2012MHz



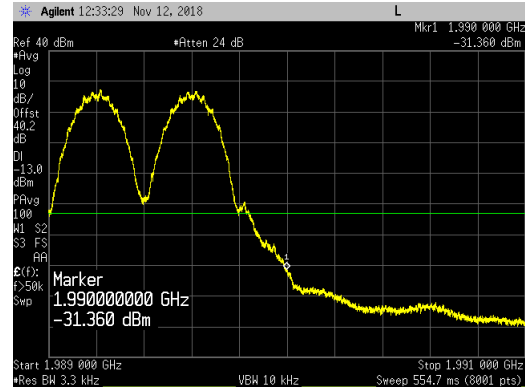
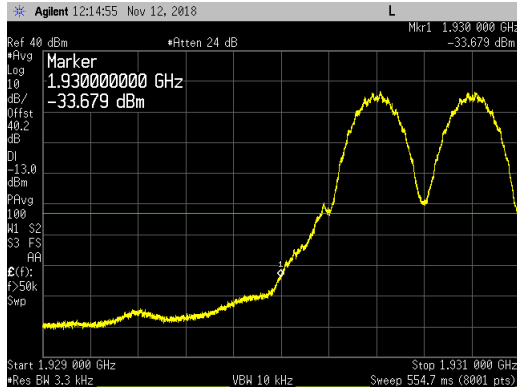
**Three Carriers at Maximum Power -Lower and Upper Band Edge Plots:**

GMSK Carriers at 1930.4, 1930.8 & 1967.4MHz

GMSK Carriers at 1989.2, 1989.6 & 1952.6MHz

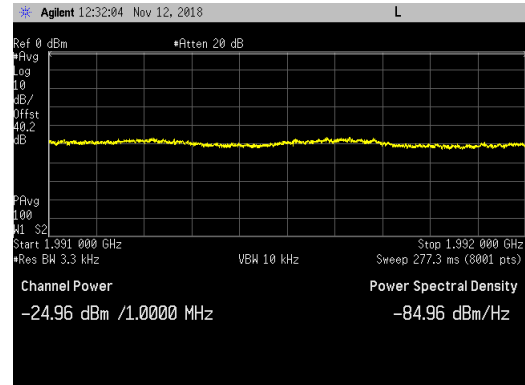
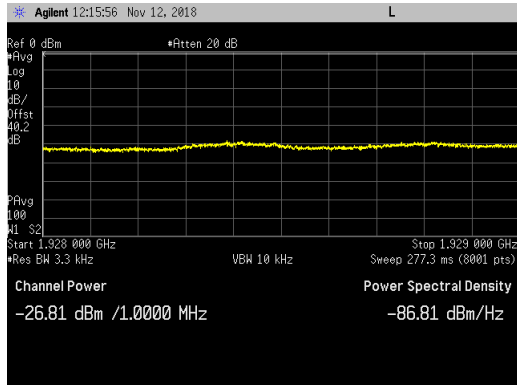
Port 2\_LBE\_1929 to 1931MHz

Port 2\_UBE\_1989 to 1991MHz



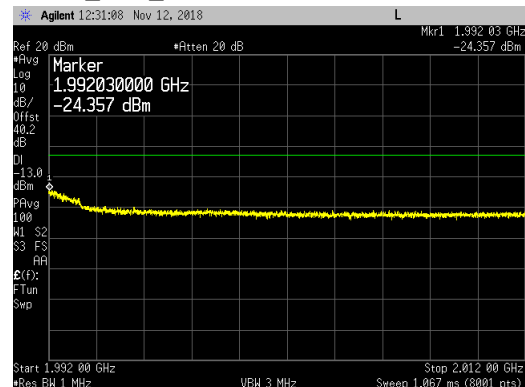
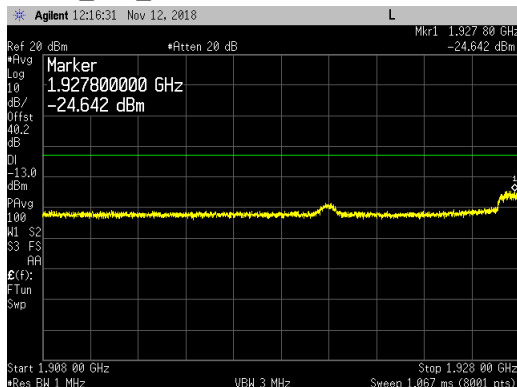
Port 2\_LBE\_1928 to 1929MHz

Port 2\_UBE\_1991 to 1992MHz



Port 2\_LBE\_1908 to 1928MHz

Port 2\_UBE\_1992 to 2012MHz



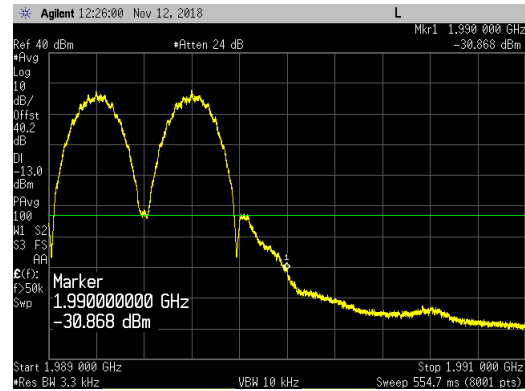
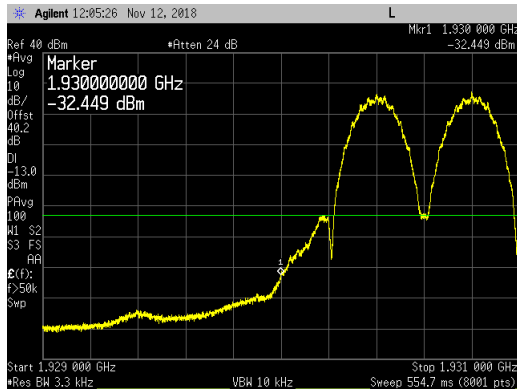
**Three Carriers at Maximum Power -Lower and Upper Band Edge Plots:**

8PSK Carriers at 1930.4, 1930.8 & 1967.4MHz

8PSK Carriers at 1989.2, 1989.6 & 1952.6MHz

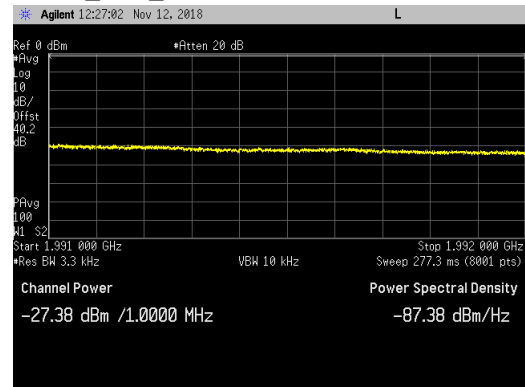
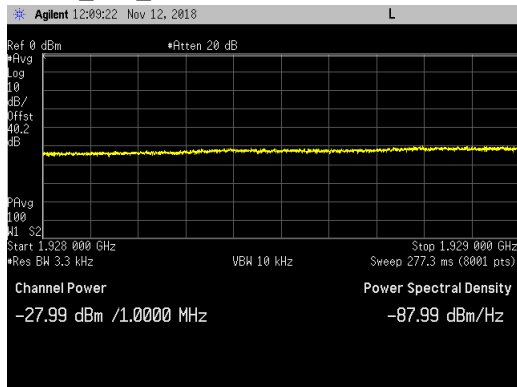
Port 2\_LBE\_1929 to 1931MHz

Port 2\_UBE\_1989 to 1991MHz



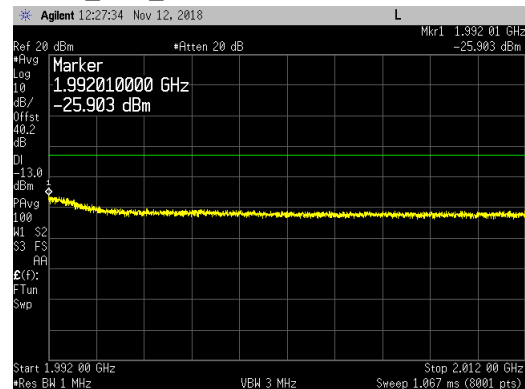
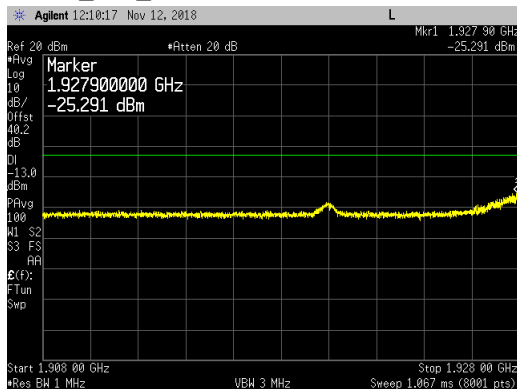
Port 2\_LBE\_1928 to 1929MHz

Port 2\_UBE\_1991 to 1992MHz



Port 2\_LBE\_1908 to 1928MHz

Port 2\_UBE\_1992 to 2012MHz



**Transmitter Antenna Port Conducted Emissions**

Transmitter conducted emission measurements were made at RRH antenna port 2 with GSM/EDGE modulation types. Measurements were performed over the 9kHz to 22GHz frequency range. The RRH was operated at maximum power with a single carrier on the Band 2 middle channel (1960.0MHz).

Two multicarrier test cases based upon KDB 971168 D03v01 using three carriers (at maximum power) per antenna port was performed. The first multicarrier test case is with two carriers (with minimum spacing between carrier frequencies) at the lower band edge (i.e.: 1930.4 & 1930.8MHz) and a third carrier with maximum spacing between the other two carrier frequencies (1967.4MHz). The second multicarrier test case is with two carriers (with minimum spacing between carrier frequencies) at upper band edge (i.e.: 1989.2 & 1989.6MHz) and a third carrier with maximum spacing between the other two carrier frequencies (1952.6MHz). A single WCDMA carrier operating at AWS band middle frequency (2140MHz) with 64QAM modulation at maximum power was enabled for all testing.

The test configuration parameters are provided below:

| PCS Band Transmission Parameters                          |              |                   | AWS Band Transmission Parameters |              |               |
|---|--------------|-------------------|----------------------------------|--------------|---------------|
| Carrier Frequency   | Channel Type | Carrier Power     | Carrier Frequency                | Channel Type | Carrier Power |
| 1960.0MHz<br>(Mid Ch)                                     | GSM/EDGE     | 40 Watts          | 2140.0MHz<br>(Mid Ch)            | WCDMA 5M     | 40 Watts      |
| 1930.4, 1930.8 & 1967.4MHz<br>(BC, BC+1, and Max Spacing) | GSM/EDGE     | 13+13+13<br>Watts | 2140.0MHz<br>(Mid Ch)            | WCDMA 5M     | 40 Watts      |
| 1989.2, 1989.6 & 1952.6MHz<br>(BC, BC+1, and Max Spacing) | GSM/EDGE     | 13+13+13<br>Watts | 2140.0MHz<br>(Mid Ch)            | WCDMA 5M     | 40 Watts      |

The power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm as specified in section 24.238(a) and RSS 133 6.5(i). The GSM/EDGE carriers are not MIMO. The required measurement parameters include a 1MHz bandwidth with power measured in average value (since transmitter power was measured in average value).

Measurements were performed with a spectrum analyzer using a peak detector with max hold over 50 sweeps (except for the 20MHz to 3GHz frequency range). Measurements for the 20MHz to 3GHz frequency range was performed with the spectrum analyzer in the RMS average mode over 100 traces.

The limit for the 9kHz to 150kHz frequency range was adjusted to -43dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 1MHz [i.e.: -43dBm = -13dBm -10log(1000kHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to -33dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 1MHz [i.e.: -33dBm = -13dBm -10log(1000kHz/10kHz)]. The required limit of -13dBm with a RBW of  $\geq 1$ MHz was used for all other frequency ranges. The spectrum analyzer settings that were used for this test are summarized in the following table.

| Frequency Range         | RBW   | VBW   | Number of Data Points | Detector | Sweep Time | Max Hold over | Offset Note 1 |
|-------------------------|-------|-------|-----------------------|----------|------------|---------------|---------------|
| <b>9kHz to 150kHz</b>   | 1kHz  | 3kHz  | 8001                  | Peak     | Auto       | 50 Sweeps     | 8.8dB         |
| <b>150kHz to 20MHz</b>  | 10kHz | 30kHz | 8001                  | Peak     | Auto       | 50 Sweeps     | 8.9dB         |
| <b>20MHz to 3000MHz</b> | 1MHz  | 3MHz  | 8001                  | Average  | Auto       | Note 2        | 40.2dB        |
| <b>3GHz to 6GHz</b>     | 1MHz  | 3MHz  | 8001                  | Peak     | Auto       | 50 Sweeps     | 40.1dB        |
| <b>6GHz to 18GHz</b>    | 2MHz  | 6MHz  | 8192                  | Peak     | Auto       | 50 Sweeps     | 33.4dB        |
| <b>18GHz to 22GHz</b>   | 1MHz  | 3MHz  | 8001                  | Peak     | Auto       | 50 Sweeps     | 40.0dB        |

Note 1: The total measurement RF path loss of the test setup (attenuators, filters and test cables) is accounted for by the spectrum analyzer reference level offset.

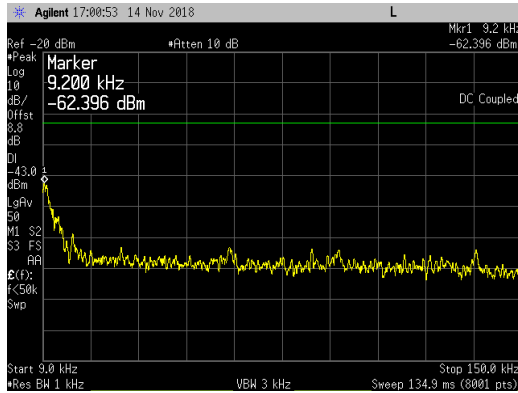
Note 2: Max Hold not used and instead measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces.

A low pass filter was used to reduce the measurement instrumentation noise floor for the frequency ranges below 20MHz. A high pass filter was used to reduce the measurement instrumentation noise floor for the frequency ranges above 6GHz. The total measurement RF path loss of the test setup (attenuators, low pass filter, high pass filter and test cables) as shown in the table is accounted for by the spectrum analyzer reference level offset. The display line on the plots reflects the required limit. Conducted spurious emission plots/measurements are provided in the following pages.

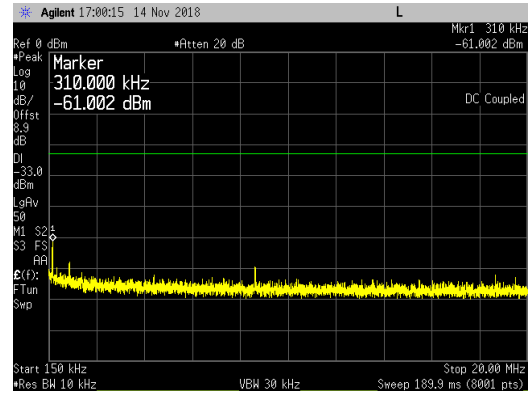


Single GSM Carrier at PCS Mid Ch (1960MHz) with Single WCDMA Carrier at AWS Mid Ch (2140MHz):

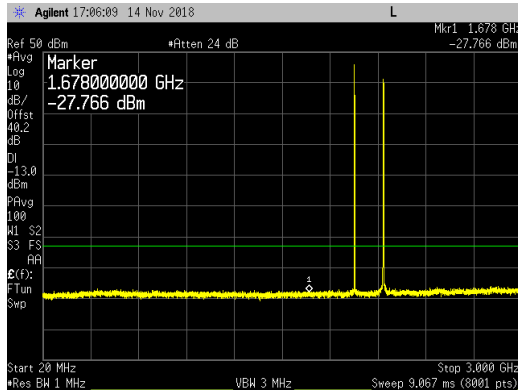
9kHz to 150kHz



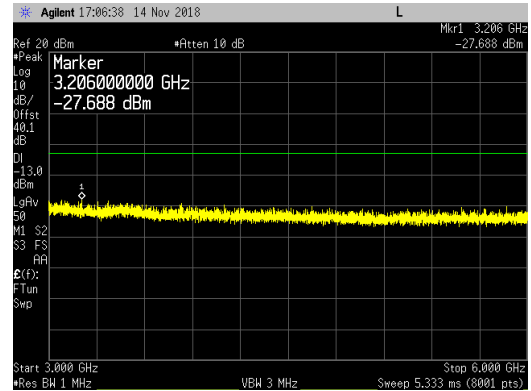
150kHz to 20MHz



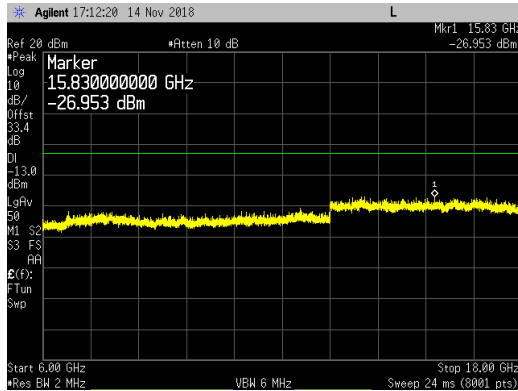
20MHz to 3000MHz



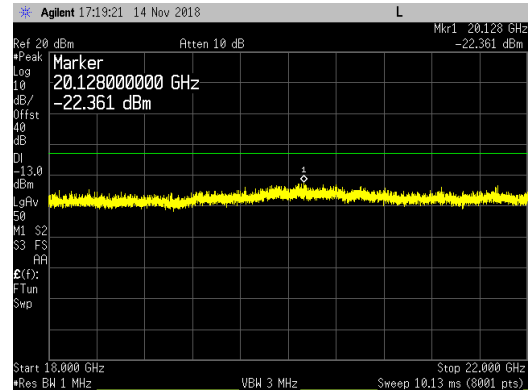
3GHz to 6GHz



6GHz to 18GHz

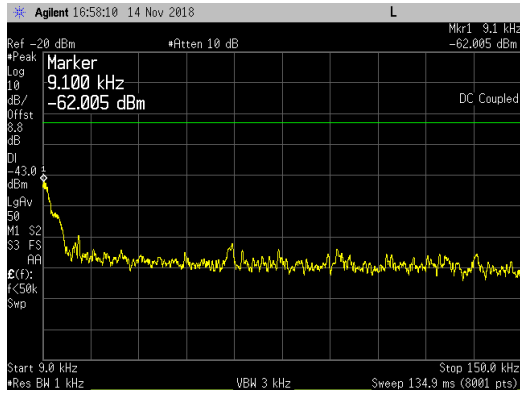


18GHz to 22GHz

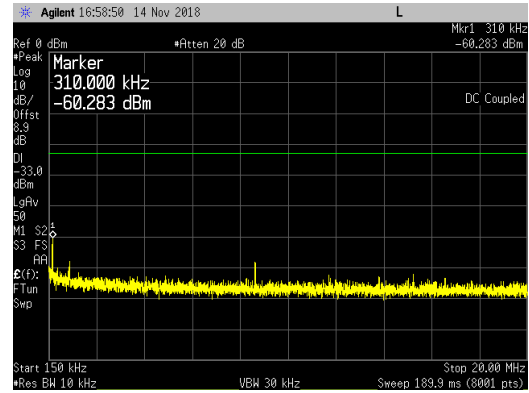


**Single 8PSK Carrier at PCS Mid Ch (1960MHz) with Single WCDMA Carrier at AWS Mid Ch (2140MHz):**

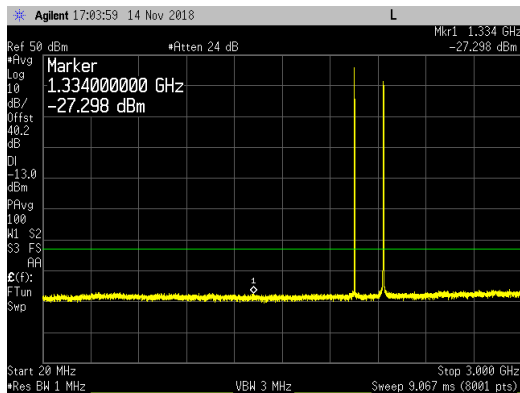
9kHz to 150kHz



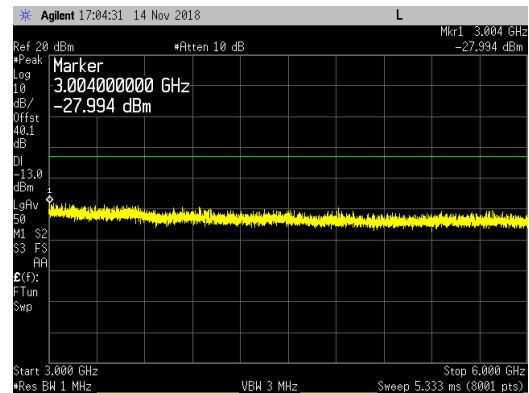
150kHz to 20MHz



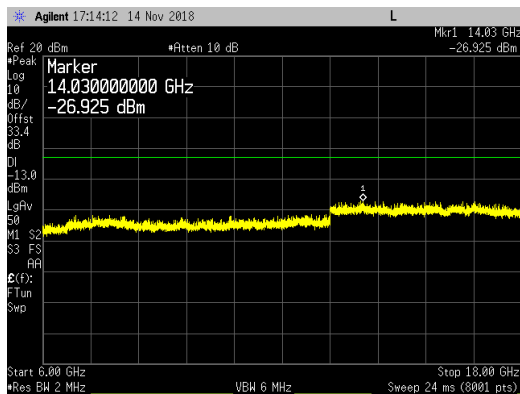
20MHz to 3000MHz



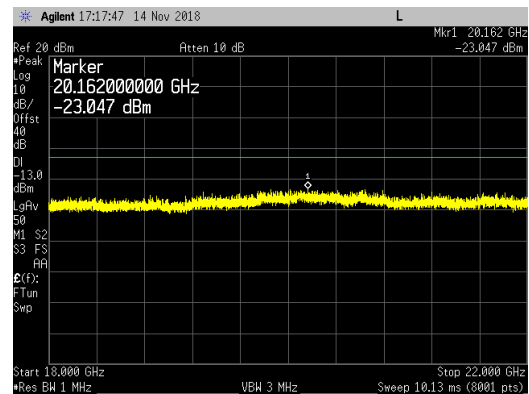
3GHz to 6GHz



6GHz to 18GHz

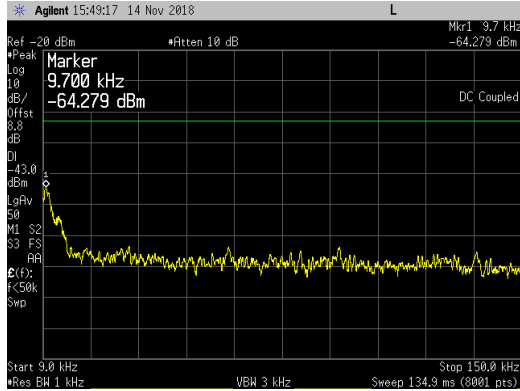


18GHz to 22GHz

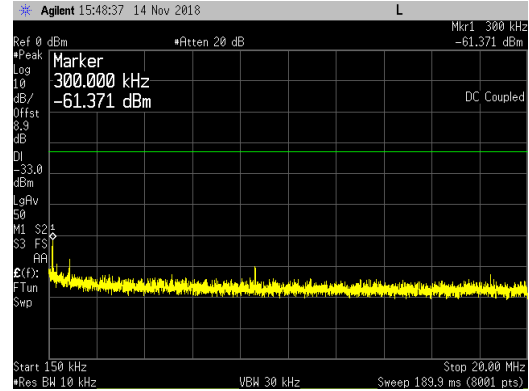


**Three GMSK Carriers at BCs (1930.4 and 1930.8MHz) and at Max Spacing (1967.4MHz) with Single WCDMA Carrier at AWS Mid Ch (2140MHz):**

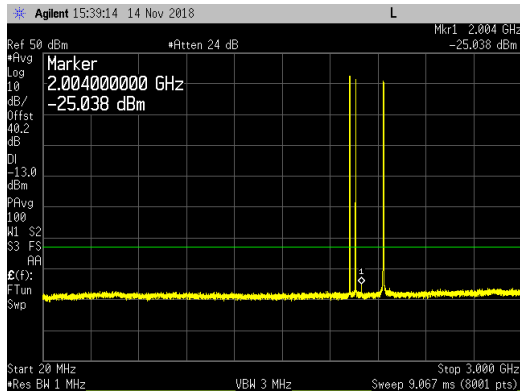
9kHz to 150kHz



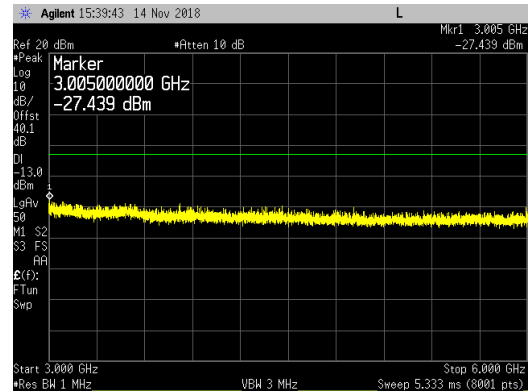
150kHz to 20MHz



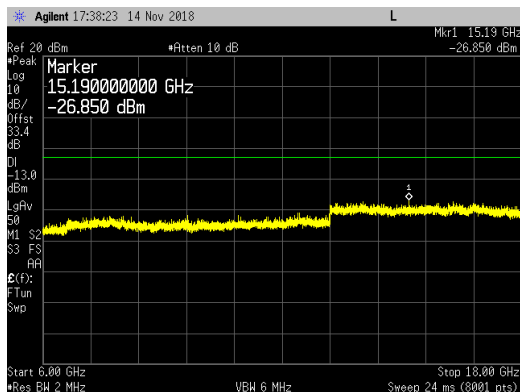
20MHz to 3000MHz



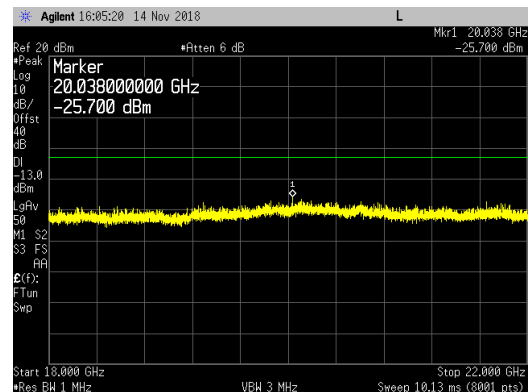
3GHz to 6GHz



6GHz to 18GHz

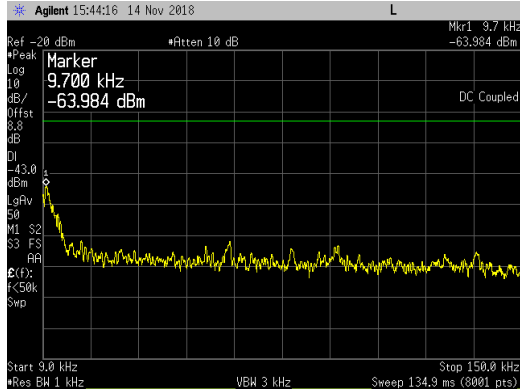


18GHz to 22GHz

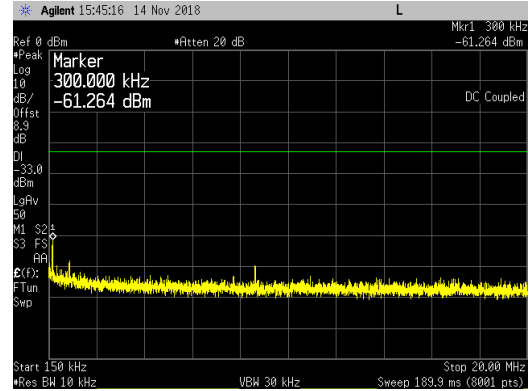


**Three 8PSK Carriers at BCs (1930.4 and 1930.8MHz) and at Max Spacing (1967.4MHz) with Single WCDMA Carrier at AWS Mid Ch (2140MHz):**

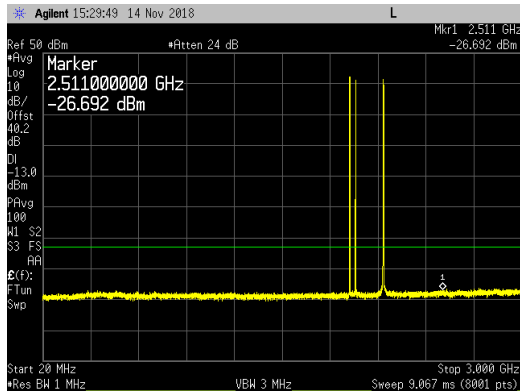
9kHz to 150kHz



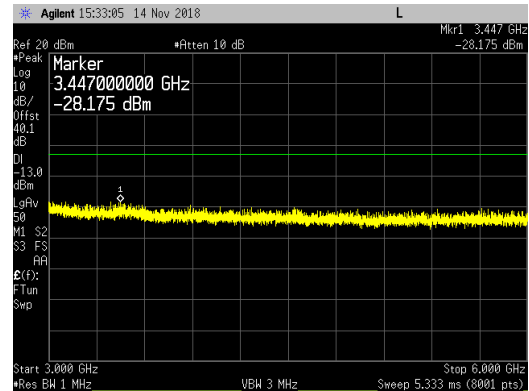
150kHz to 20MHz



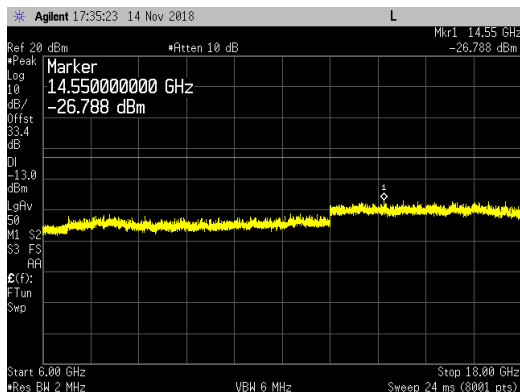
20MHz to 3000MHz



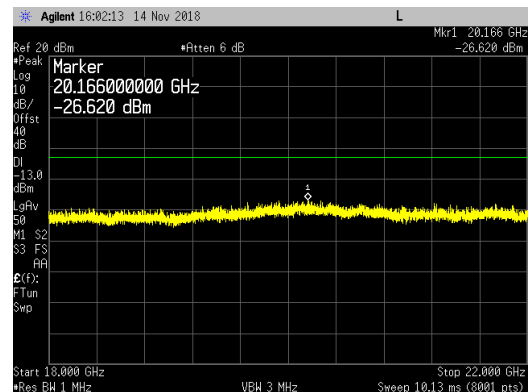
3GHz to 6GHz



6GHz to 18GHz

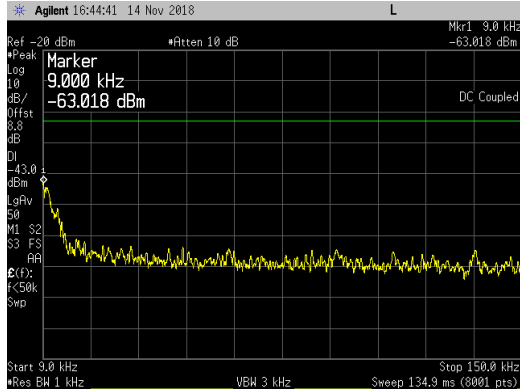


18GHz to 22GHz

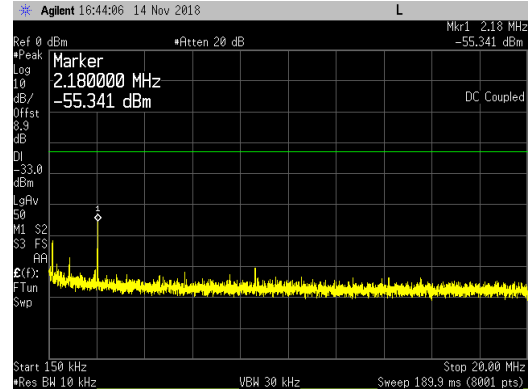


**Three GSMK Carriers at TCs (1989.2 and 1989.6MHz) and at Max Spacing (1952.6MHz) with Single WCDMA Carrier at AWS Mid Ch (2140MHz):**

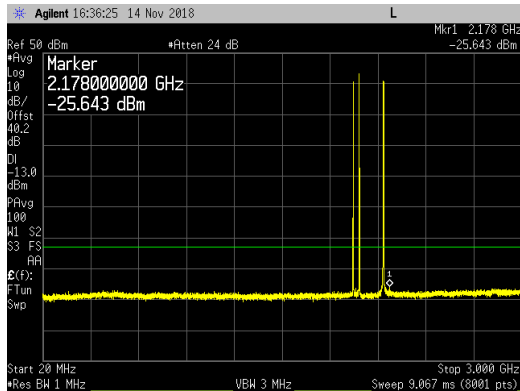
9kHz to 150kHz



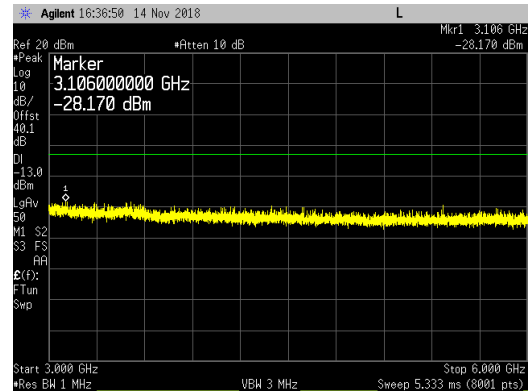
150kHz to 20MHz



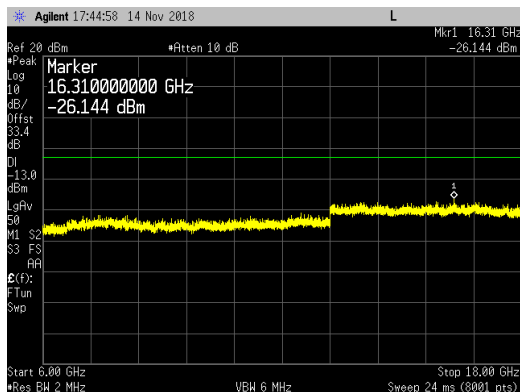
20MHz to 3000MHz



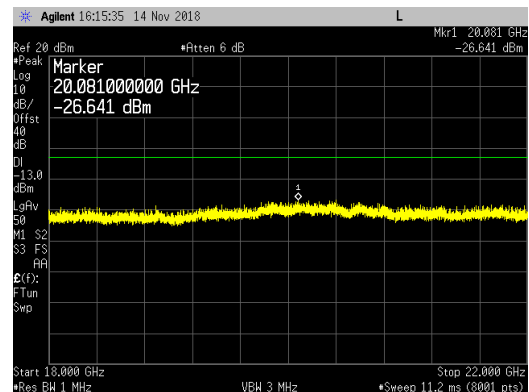
3GHz to 6GHz



6GHz to 18GHz

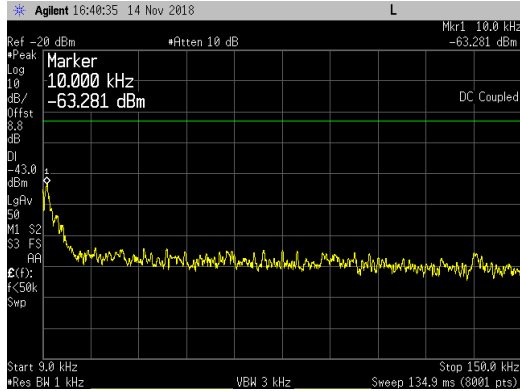


18GHz to 22GHz

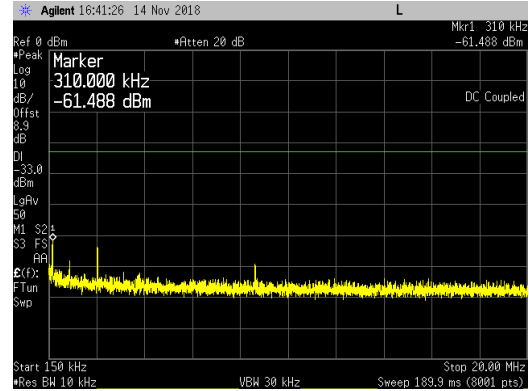


**Three 8PSK Carriers at TCs (1989.2 and 1989.6MHz) and at Max Spacing (1952.6MHz) with Single WCDMA Carrier at AWS Mid Ch (2140MHz):**

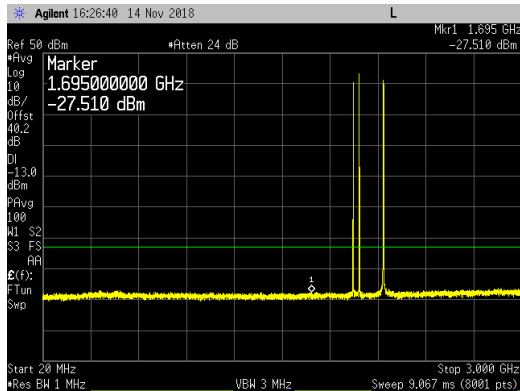
9kHz to 150kHz



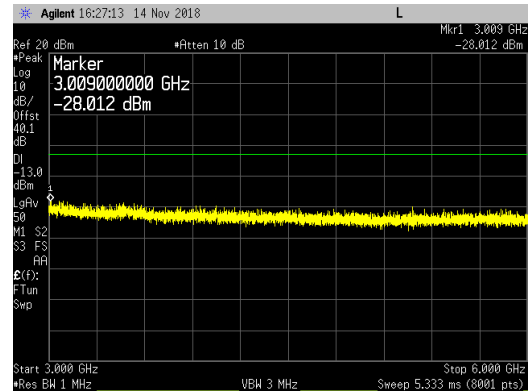
150kHz to 20MHz



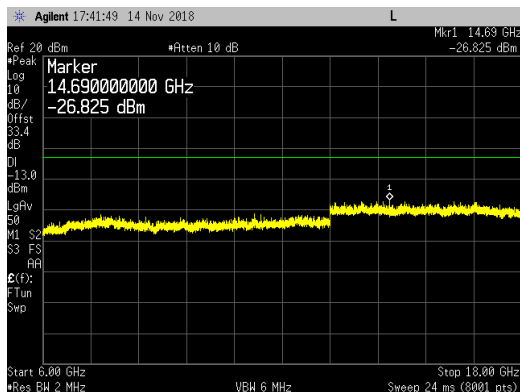
20MHz to 3000MHz



3GHz to 6GHz



6GHz to 18GHz



18GHz to 22GHz

