



**FCC CFR47 PART 27 SUBPART M**

**WWAN Uplink Carrier Aggregation**

**CERTIFICATION TEST REPORT**

**FOR**

**GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT**

**MODEL NUMBER : SM-N970F/DS, SM-N970F, SM-N970X**

**FCC ID: A3LSMN970F**

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Testing  
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**TL-637**

Revision History

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SAMSUNG ELECTRONICS CO., LTD.

**EUT DESCRIPTION:** GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT

**MODEL NUMBER:** SM-N970F/DS, SM-N970F, SM-N970X

**SERIAL NUMBER:** R38M502PEHK, R38M60378KA, R38M6037BNV (CONDUCTED)  
R38M502Q83H, R38M603796L, R38M6037CGW (RADIATED);

**DATE TESTED:** JUN 21, 2019 – JUN 27, 2019;

| APPLICABLE STANDARDS |              |
|----------------------|--------------|
| STANDARD             | TEST RESULTS |
| FCC PART 27M         | Pass         |

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For  
UL Korea, Ltd. By:



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Suwon Lab Engineer  
UL Korea, Ltd.

Tested By:



Junwhan Lee  
Suwon Lab Engineer  
UL Korea, Ltd.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 27.
3. ANSI TIA-603-E, 2016
4. ANSI C63.26, 2015
5. KDB 971168 D01 Power Meas License Digital Systems v03r01

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 218 Maeyeong-ro                     |           |
|-------------------------------------|-----------|
| <input checked="" type="checkbox"/> | Chamber 1 |
| <input checked="" type="checkbox"/> | Chamber 2 |
| <input type="checkbox"/>            | Chamber 3 |

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.pdf>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

EIRP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss( between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss( between the SG and substitution antenna)

(Path loss = Signal generator output – PSA reading with substitution antenna)

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER                              | UNCERTAINTY |
|----------------------------------------|-------------|
| Conducted Disturbance, 0.15 to 30 MHz  | 2.32 dB     |
| Radiated Disturbance, 30 MHz to 1 GHz  | 3.86 dB     |
| Radiated Disturbance, 1 GHz to 18 GHz  | 5.97 dB     |
| Radiated Disturbance, 18 GHz to 40 GHz | 5.57 dB     |

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT. This test report addresses the WWAN Uplink Carrier Aggregation operational mode.

This report covers the Samsung models SM-N970F/DS, SM-N970F and SM-N970X. These models are identical in hardware except SM-N970F has single SIM tray and model SM-N970X has been disabled all cellular bands by software. With some pre-scan, model SM-N970F/DS was set for final test.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum average EIRP output powers as follows:

#### LTE Band 38C (Uplink CA)

| Part 27            |                             |            |                            |                    |       |             |
|--------------------|-----------------------------|------------|----------------------------|--------------------|-------|-------------|
| EIRP Limit (dBm)   |                             | 33.00      |                            |                    |       |             |
| Antenna Gain (dBi) |                             | -5.00      |                            |                    |       |             |
| Bandwidth<br>(MHz) | Frequency<br>Range<br>(MHz) | Modulation | OUTPUT POWER               |                    |       |             |
|                    |                             |            | Conducted<br>Average (dBm) | EIRP Average (dBm) |       | Margin (dB) |
|                    |                             |            |                            | dBm                | mW    |             |
| 15+15              | 2570-2620                   | QPSK       | 23.77                      | 18.77              | 75.34 | -14.23      |
|                    |                             | 16QAM      | 22.68                      | 17.68              | 58.61 | -15.32      |
|                    |                             | 64QAM      | 20.76                      | 15.76              | 37.67 | -17.24      |
| 20+20              |                             | QPSK       | 23.80                      | 18.80              | 75.86 | -14.20      |
|                    |                             | 16QAM      | 22.76                      | 17.76              | 59.70 | -15.24      |
|                    |                             | 64QAM      | 20.78                      | 15.78              | 37.84 | -17.22      |

**LTE Band 7C (Uplink CA)**

| Part 27            |                             |            |                            |                    |        |             |
|--------------------|-----------------------------|------------|----------------------------|--------------------|--------|-------------|
| EIRP Limit (dBm)   |                             | 33.00      |                            |                    |        |             |
| Antenna Gain (dBi) |                             | -4.11      |                            |                    |        |             |
| Bandwidth<br>(MHz) | Frequency<br>Range<br>(MHz) | Modulation | OUTPUT POWER               |                    |        |             |
|                    |                             |            | Conducted<br>Average (dBm) | EIRP Average (dBm) |        | Margin (dB) |
| dBm                | mW                          |            |                            |                    |        |             |
| 15+10              | 2500-2570                   | QPSK       | 23.85                      | 19.74              | 94.19  | -13.26      |
|                    |                             | 16QAM      | 23.15                      | 19.04              | 80.17  | -13.96      |
|                    |                             | 64QAM      | 21.13                      | 17.02              | 50.35  | -15.98      |
| 10+20              |                             | QPSK       | 24.17                      | 20.06              | 101.39 | -12.94      |
|                    |                             | 16QAM      | 23.51                      | 19.40              | 87.10  | -13.60      |
|                    |                             | 64QAM      | 21.14                      | 17.03              | 50.47  | -15.97      |
| 15+15              |                             | QPSK       | 24.09                      | 19.98              | 99.54  | -13.02      |
|                    |                             | 16QAM      | 23.32                      | 19.21              | 83.37  | -13.79      |
|                    |                             | 64QAM      | 21.24                      | 17.13              | 51.64  | -15.87      |
| 20+10              |                             | QPSK       | 23.94                      | 19.83              | 96.16  | -13.17      |
|                    |                             | 16QAM      | 23.13                      | 19.02              | 79.80  | -13.98      |
|                    |                             | 64QAM      | 21.39                      | 17.28              | 53.46  | -15.72      |
| 15+20              |                             | QPSK       | 24.18                      | 20.07              | 101.62 | -12.93      |
|                    |                             | 16QAM      | 23.44                      | 19.33              | 85.70  | -13.67      |
|                    |                             | 64QAM      | 21.25                      | 17.14              | 51.76  | -15.86      |
| 20+15              |                             | QPSK       | 23.94                      | 19.83              | 96.16  | -13.17      |
|                    |                             | 16QAM      | 23.27                      | 19.16              | 82.41  | -13.84      |
|                    |                             | 64QAM      | 21.42                      | 17.31              | 53.83  | -15.69      |
| 20+20              |                             | QPSK       | 24.04                      | 19.93              | 98.40  | -13.07      |
|                    |                             | 16QAM      | 23.48                      | 19.37              | 86.50  | -13.63      |
|                    |                             | 64QAM      | 21.45                      | 17.34              | 54.20  | -15.66      |

### 5.3. RF OUTPUT POWER VERIFICATION (CONDUCTED AND EIRP)

#### RULE PART(S)

FCC: §2.1046, §27.50

#### EIRP LIMIT

FCC: §27.50(h)

(h) The following power limits shall apply in the BRS and EBS:

(2) Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

#### TEST PROCEDURE

TIA-603-E Clause 2.2.17

KDB 971168 Section 5.6

$$\text{ERP/EIRP} = \text{PMeas} + \text{GT} - \text{LC}$$

where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);

PMeas = measured transmitter output power or PSD, in dBm or dBW;

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

#### RESULTS

EUT includes different power levels for head use configuration and body use configuration and the below tables contain the highest of all configurations average conducted and ERP/EIRP output powers as follows:

### OUTPUT POWER FOR LTE BAND 7C (15.0MHz + 10.0MHz)

| Antenna Gain (dBi) | -4.11               |                     |        |        |        |        |                         |       |       |
|--------------------|---------------------|---------------------|--------|--------|--------|--------|-------------------------|-------|-------|
| Bandwidth          | PCC Frequency (MHz) | SCC Frequency (MHz) | PCC RB | PCC RB | SCC RB | SCC RB | Conducted Average (dBm) |       |       |
|                    |                     |                     | Size   | Offset | Size   | Offset | QPSK                    | 16QAM | 64QAM |
| 15MHz / 10MHz      | 2507.5              | 2519.5              | 1      | 74     | 1      | 0      | 23.85                   | 23.15 | 21.13 |
|                    |                     |                     | 1      | 0      | 1      | 49     | 15.89                   | 16.21 | 16.28 |
|                    |                     |                     | 75     | 0      | 50     | 0      | 22.13                   | 21.09 | 21.07 |
|                    | 2527.5              | 2539.5              | 1      | 74     | 1      | 0      | 23.36                   | 22.83 | 20.78 |
|                    |                     |                     | 1      | 0      | 1      | 49     | 15.42                   | 15.90 | 15.79 |
|                    |                     |                     | 75     | 0      | 50     | 0      | 21.67                   | 20.69 | 20.61 |
|                    | 2552.5              | 2564.5              | 1      | 74     | 1      | 0      | 23.57                   | 22.97 | 21.10 |
|                    |                     |                     | 1      | 0      | 1      | 49     | 15.57                   | 15.99 | 16.22 |
|                    |                     |                     | 75     | 0      | 50     | 0      | 21.91                   | 20.88 | 20.79 |

### OUTPUT POWER FOR LTE BAND 7C (10.0MHz + 20.0MHz)

| Antenna Gain (dBi) | -4.11               |                     |        |        |        |        |                         |       |       |
|--------------------|---------------------|---------------------|--------|--------|--------|--------|-------------------------|-------|-------|
| Bandwidth          | PCC Frequency (MHz) | SCC Frequency (MHz) | PCC RB | PCC RB | SCC RB | SCC RB | Conducted Average (dBm) |       |       |
|                    |                     |                     | Size   | Offset | Size   | Offset | QPSK                    | 16QAM | 64QAM |
| 10MHz / 20MHz      | 2505.5              | 2519.9              | 1      | 49     | 1      | 0      | 24.17                   | 23.51 | 21.14 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 15.95                   | 16.51 | 16.19 |
|                    |                     |                     | 50     | 0      | 100    | 0      | 22.08                   | 21.11 | 21.08 |
|                    | 2525.6              | 2540.0              | 1      | 49     | 1      | 0      | 23.67                   | 23.36 | 20.69 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 15.47                   | 16.15 | 15.62 |
|                    |                     |                     | 50     | 0      | 100    | 0      | 21.61                   | 20.65 | 20.60 |
|                    | 2545.6              | 2560.0              | 1      | 49     | 1      | 0      | 23.78                   | 23.02 | 20.81 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 15.52                   | 15.85 | 15.74 |
|                    |                     |                     | 50     | 0      | 100    | 0      | 21.68                   | 20.68 | 20.65 |

### OUTPUT POWER FOR LTE BAND 7C (15.0MHz + 15.0MHz)

| Antenna Gain (dBi) | -4.11               |                     |        |        |        |        |                         |       |       |
|--------------------|---------------------|---------------------|--------|--------|--------|--------|-------------------------|-------|-------|
| Bandwidth          | PCC Frequency (MHz) | SCC Frequency (MHz) | PCC RB | PCC RB | SCC RB | SCC RB | Conducted Average (dBm) |       |       |
|                    |                     |                     | Size   | Offset | Size   | Offset | QPSK                    | 16QAM | 64QAM |
| 15MHz / 15MHz      | 2507.5              | 2522.5              | 1      | 74     | 1      | 0      | 24.09                   | 23.32 | 21.24 |
|                    |                     |                     | 1      | 0      | 1      | 74     | 15.81                   | 16.35 | 16.15 |
|                    |                     |                     | 75     | 0      | 75     | 0      | 22.23                   | 21.16 | 21.14 |
|                    | 2527.5              | 2542.5              | 1      | 74     | 1      | 0      | 23.60                   | 23.09 | 20.71 |
|                    |                     |                     | 1      | 0      | 1      | 74     | 15.52                   | 16.01 | 15.74 |
|                    |                     |                     | 75     | 0      | 75     | 0      | 21.73                   | 20.73 | 20.67 |
|                    | 2547.5              | 2562.5              | 1      | 74     | 1      | 0      | 23.75                   | 23.12 | 21.07 |
|                    |                     |                     | 1      | 0      | 1      | 74     | 15.54                   | 16.06 | 16.00 |
|                    |                     |                     | 75     | 0      | 75     | 0      | 21.88                   | 20.80 | 20.76 |

### OUTPUT POWER FOR LTE BAND 7C (20.0MHz + 10.0MHz)

| Antenna Gain (dBi) | -4.11               |                     |        |        |        |        |                         |       |       |
|--------------------|---------------------|---------------------|--------|--------|--------|--------|-------------------------|-------|-------|
| Bandwidth          | PCC Frequency (MHz) | SCC Frequency (MHz) | PCC RB | PCC RB | SCC RB | SCC RB | Conducted Average (dBm) |       |       |
|                    |                     |                     | Size   | Offset | Size   | Offset | QPSK                    | 16QAM | 64QAM |
| 20MHz / 10MHz      | 2510.0              | 2524.4              | 1      | 99     | 1      | 0      | 23.94                   | 23.13 | 21.39 |
|                    |                     |                     | 1      | 0      | 1      | 49     | 15.98                   | 16.32 | 16.43 |
|                    |                     |                     | 100    | 0      | 50     | 0      | 21.96                   | 20.93 | 20.91 |
|                    | 2530.1              | 2544.5              | 1      | 99     | 1      | 0      | 23.43                   | 22.83 | 20.87 |
|                    |                     |                     | 1      | 0      | 1      | 49     | 15.42                   | 15.96 | 15.90 |
|                    |                     |                     | 100    | 0      | 50     | 0      | 21.62                   | 20.59 | 20.57 |
|                    | 2550.1              | 2564.5              | 1      | 99     | 1      | 0      | 23.63                   | 23.07 | 20.87 |
|                    |                     |                     | 1      | 0      | 1      | 49     | 15.64                   | 16.25 | 15.93 |
|                    |                     |                     | 100    | 0      | 50     | 0      | 21.74                   | 20.68 | 20.67 |

### OUTPUT POWER FOR LTE BAND 7C (15.0MHz + 20.0MHz)

| Antenna Gain (dBi) | -4.11               |                     |        |        |        |        |                         |       |       |
|--------------------|---------------------|---------------------|--------|--------|--------|--------|-------------------------|-------|-------|
| Bandwidth          | PCC Frequency (MHz) | SCC Frequency (MHz) | PCC RB | PCC RB | SCC RB | SCC RB | Conducted Average (dBm) |       |       |
|                    |                     |                     | Size   | Offset | Size   | Offset | QPSK                    | 16QAM | 64QAM |
| 15MHz / 20MHz      | 2507.8              | 2524.9              | 1      | 74     | 1      | 0      | 24.18                   | 23.44 | 21.25 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 15.97                   | 16.38 | 16.27 |
|                    |                     |                     | 75     | 0      | 100    | 0      | 22.25                   | 21.18 | 21.18 |
|                    | 2525.30             | 2542.40             | 1      | 74     | 1      | 0      | 23.65                   | 23.17 | 21.13 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 15.45                   | 16.01 | 15.99 |
|                    |                     |                     | 75     | 0      | 100    | 0      | 21.78                   | 20.77 | 20.79 |
|                    | 2542.9              | 2560.0              | 1      | 74     | 1      | 0      | 23.87                   | 23.15 | 21.08 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 15.59                   | 16.08 | 15.79 |
|                    |                     |                     | 75     | 0      | 100    | 0      | 21.83                   | 20.82 | 20.79 |

### OUTPUT POWER FOR LTE BAND 7C (20.0MHz + 15.0MHz)

| Antenna Gain (dBi) | -4.11               |                     |        |        |        |        |                         |       |       |
|--------------------|---------------------|---------------------|--------|--------|--------|--------|-------------------------|-------|-------|
| Bandwidth          | PCC Frequency (MHz) | SCC Frequency (MHz) | PCC RB | PCC RB | SCC RB | SCC RB | Conducted Average (dBm) |       |       |
|                    |                     |                     | Size   | Offset | Size   | Offset | QPSK                    | 16QAM | 64QAM |
| 20MHz / 15MHz      | 2510.0              | 2527.1              | 1      | 99     | 1      | 0      | 23.94                   | 23.27 | 21.42 |
|                    |                     |                     | 1      | 0      | 1      | 74     | 15.93                   | 16.41 | 16.37 |
|                    |                     |                     | 100    | 0      | 75     | 0      | 21.96                   | 20.94 | 20.92 |
|                    | 2527.6              | 2544.7              | 1      | 99     | 1      | 0      | 23.46                   | 22.97 | 20.72 |
|                    |                     |                     | 1      | 0      | 1      | 74     | 15.45                   | 16.02 | 15.73 |
|                    |                     |                     | 100    | 0      | 75     | 0      | 21.59                   | 20.61 | 20.59 |
|                    | 2545.1              | 2562.2              | 1      | 99     | 1      | 0      | 23.49                   | 23.01 | 20.91 |
|                    |                     |                     | 1      | 0      | 1      | 74     | 15.59                   | 16.16 | 16.01 |
|                    |                     |                     | 100    | 0      | 75     | 0      | 21.71                   | 20.66 | 20.63 |

### OUTPUT POWER FOR LTE BAND 7C (20.0MHz + 20.0MHz)

| Antenna Gain (dBi) | -4.11               |                     |        |        |        |        |                         |       |       |
|--------------------|---------------------|---------------------|--------|--------|--------|--------|-------------------------|-------|-------|
| Bandwidth          | PCC Frequency (MHz) | SCC Frequency (MHz) | PCC RB | PCC RB | SCC RB | SCC RB | Conducted Average (dBm) |       |       |
|                    |                     |                     | Size   | Offset | Size   | Offset | QPSK                    | 16QAM | 64QAM |
| 20MHz / 20MHz      | 2510.0              | 2529.8              | 1      | 99     | 1      | 0      | 24.04                   | 23.48 | 21.45 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 15.82                   | 16.43 | 16.15 |
|                    |                     |                     | 100    | 0      | 100    | 0      | 21.97                   | 20.93 | 20.91 |
|                    | 2525.1              | 2544.9              | 1      | 99     | 1      | 0      | 23.70                   | 23.19 | 21.23 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 15.69                   | 16.05 | 16.10 |
|                    |                     |                     | 100    | 0      | 100    | 0      | 21.66                   | 20.68 | 20.66 |
|                    | 2540.2              | 2560.0              | 1      | 99     | 1      | 0      | 23.66                   | 23.06 | 21.27 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 15.53                   | 15.96 | 16.13 |
|                    |                     |                     | 100    | 0      | 100    | 0      | 21.65                   | 20.63 | 20.59 |

**OUTPUT POWER FOR LTE BAND 38C (15.0MHz + 15.0MHz)**

| Antenna Gain (dBi) | -5.00               |                     |        |        |        |        |                         |       |       |
|--------------------|---------------------|---------------------|--------|--------|--------|--------|-------------------------|-------|-------|
| Bandwidth          | PCC Frequency (MHz) | SCC Frequency (MHz) | PCC RB | PCC RB | SCC RB | SCC RB | Conducted Average (dBm) |       |       |
|                    |                     |                     | Size   | Offset | Size   | Offset | QPSK                    | 16QAM | 64QAM |
| 15MHz / 15MHz      | 2577.5              | 2592.5              | 1      | 74     | 1      | 0      | 23.72                   | 22.68 | 20.76 |
|                    |                     |                     | 1      | 0      | 1      | 74     | 14.98                   | 15.06 | 15.15 |
|                    |                     |                     | 75     | 0      | 75     | 0      | 21.44                   | 20.34 | 20.33 |
|                    | 2587.5              | 2602.5              | 1      | 74     | 1      | 0      | 23.77                   | 22.64 | 20.58 |
|                    |                     |                     | 1      | 0      | 1      | 74     | 15.03                   | 14.79 | 14.98 |
|                    |                     |                     | 75     | 0      | 75     | 0      | 21.50                   | 20.42 | 20.40 |
|                    | 2597.5              | 2612.5              | 1      | 74     | 1      | 0      | 23.73                   | 22.67 | 20.59 |
|                    |                     |                     | 1      | 0      | 1      | 74     | 15.07                   | 15.10 | 15.09 |
|                    |                     |                     | 75     | 0      | 75     | 0      | 21.46                   | 20.39 | 20.35 |

**OUTPUT POWER FOR LTE BAND 38C (20.0MHz + 20.0MHz)**

| Antenna Gain (dBi) | -5.00               |                     |        |        |        |        |                         |       |       |
|--------------------|---------------------|---------------------|--------|--------|--------|--------|-------------------------|-------|-------|
| Bandwidth          | PCC Frequency (MHz) | SCC Frequency (MHz) | PCC RB | PCC RB | SCC RB | SCC RB | Conducted Average (dBm) |       |       |
|                    |                     |                     | Size   | Offset | Size   | Offset | QPSK                    | 16QAM | 64QAM |
| 20MHz / 20MHz      | 2580.0              | 2599.8              | 1      | 99     | 1      | 0      | 23.79                   | 22.58 | 20.78 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 14.86                   | 14.67 | 14.91 |
|                    |                     |                     | 100    | 0      | 100    | 0      | 21.29                   | 20.17 | 20.16 |
|                    | 2585.1              | 2604.9              | 1      | 99     | 1      | 0      | 23.80                   | 22.76 | 20.68 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 14.93                   | 14.90 | 14.88 |
|                    |                     |                     | 100    | 0      | 100    | 0      | 21.32                   | 20.27 | 20.25 |
|                    | 2590.2              | 2610.0              | 1      | 99     | 1      | 0      | 23.71                   | 22.75 | 20.54 |
|                    |                     |                     | 1      | 0      | 1      | 99     | 14.86                   | 14.87 | 14.85 |
|                    |                     |                     | 100    | 0      | 100    | 0      | 21.32                   | 20.18 | 20.15 |

## 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a internal antenna for the [List the bands supported] with a maximum peak gain as follow:

| Frequency (MHz)                | Peak Gain (dBi) |
|--------------------------------|-----------------|
| LTE Band 38<br>2570 ~ 2620 MHz | -4.11           |
| LTE Band 7<br>2500 ~ 2570 MHz  | -5.00           |

## 5.5. WORST-CASE ORIENTATION

The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM and 64QAM modulations. It was found that QPSK and 16QAM results were worst case. All testing was performed using QPSK and 16QAM modulations to represent the worst case. However, the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest power in QPSK.

| Highest power setting for each bands |                   |                 |                 |         |           |
|--------------------------------------|-------------------|-----------------|-----------------|---------|-----------|
| LTE Band                             | Component Carrier | Frequency (MHz) | Bandwidth (MHz) | RB size | RB offset |
| 7<br>(Uplink CA)                     | PCC               | 2507.8          | 15              | 1       | 74        |
|                                      | SCC               | 2524.9          | 20              | 1       | 0         |
| 38<br>(Uplink CA)                    | PCC               | 2585.1          | 20              | 1       | 99        |
|                                      | SCC               | 2604.9          | 20              | 1       | 0         |

### - Radiated spurious emissions

For LTE CA\_7C, the spurious emissions was investigated in three orthogonal orientations X, Y and Z it was determined that Z orientation was worst-case orientation.

For LTE CA\_38C the spurious emissions was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation.

Note : The EUT attached with travel adapter for the worst case condition. The EUT is continuously communicated with the call box during the tests.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |          |                |        |
|------------------------|--------------|----------|----------------|--------|
| Description            | Manufacturer | Model    | Serial Number  | FCC ID |
| Charger                | SAMSUNG      | EP-TA800 | R37M5DL3FL1SE3 | N/A    |
| Data Cable             | SAMSUNG      | EP-DG977 | N/A            | N/A    |

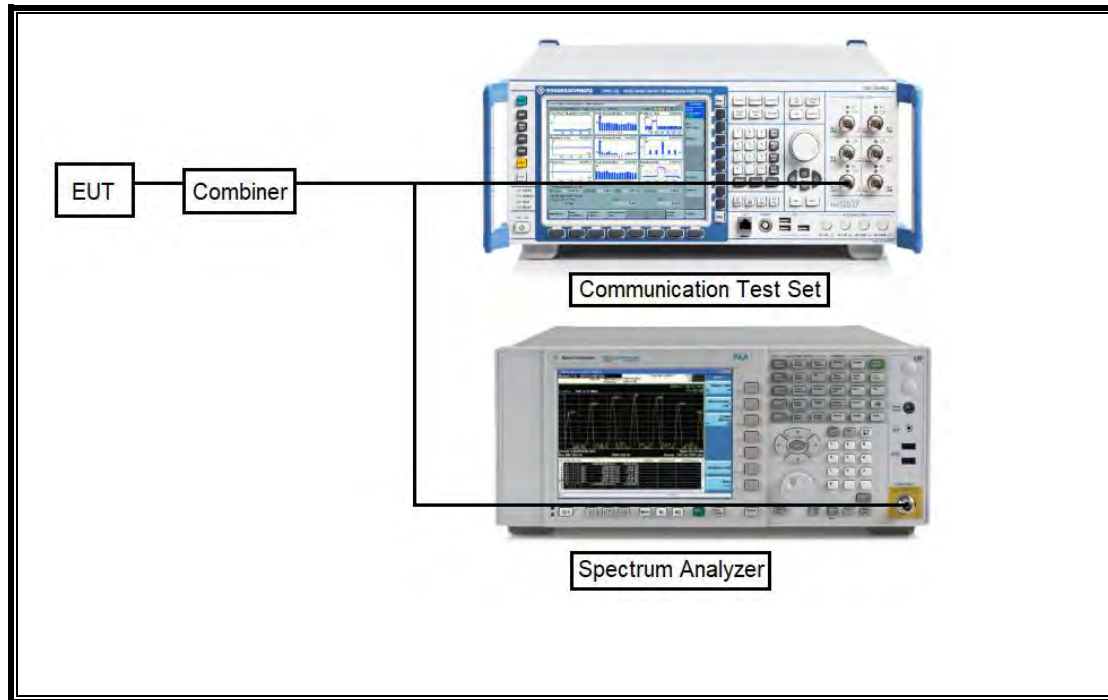
### I/O CABLE

| I/O Cable List |          |                      |                |            |                  |         |
|----------------|----------|----------------------|----------------|------------|------------------|---------|
| Cable No       | Port     | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1              | DC Power | 1                    | C Type         | Shielded   | 1.0m             | N/A     |

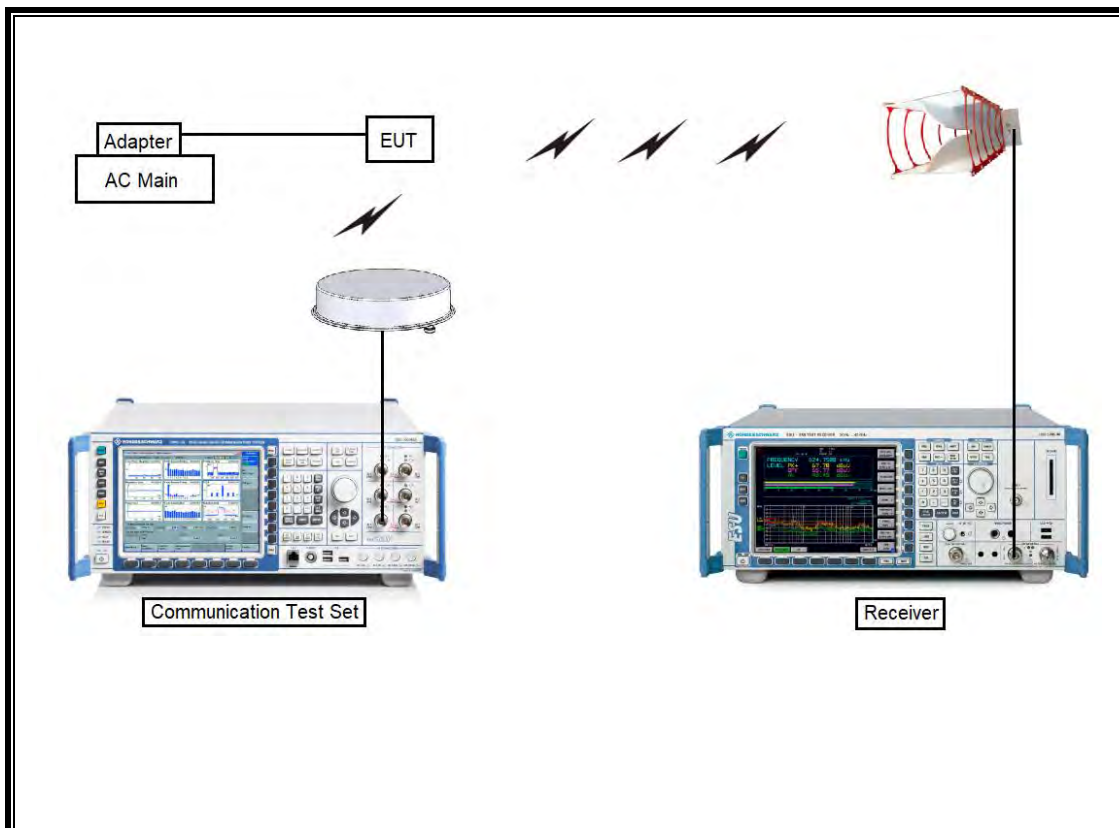
### TEST SETUP

The EUT is continuously communicated to the call box during the tests.

**SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)**



**SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| Test Equipment List                   |               |                        |            |          |
|---------------------------------------|---------------|------------------------|------------|----------|
| Description                           | Manufacturer  | Model                  | S/N        | Cal Due  |
| Antenna, Tuned Dipole<br>400~1000 MHz | ETS           | 3121D DB4              | 00164753   | 06-30-19 |
| Antenna, Horn, 40 GHz                 | ETS           | 3116C                  | 00166155   | 08-14-20 |
| Preamplifier                          | ETS           | 3116C-PA               | 00168841   | 08-09-19 |
| Antenna, Horn, 40 GHz                 | ETS           | 3116C                  | 00168645   | 12-04-19 |
| Antenna, Bilog, 30MHz-1GHz            | SCHWARZBECK   | VULB9163               | 750        | 08-04-20 |
| Antenna, Bilog, 30MHz-1GHz            | SCHWARZBECK   | VULB9163               | 845        | 08-04-20 |
| Antenna, Bilog, 30MHz-1GHz            | SCHWARZBECK   | VULB9163               | 749        | 08-04-20 |
| Antenna, Horn, 18 GHz                 | ETS           | 3115                   | 00167211   | 08-04-20 |
| Antenna, Horn, 18 GHz                 | ETS           | 3115                   | 00161451   | 08-04-20 |
| Antenna, Horn, 18 GHz                 | ETS           | 3117                   | 00168724   | 08-04-20 |
| Antenna, Horn, 18 GHz                 | ETS           | 3117                   | 00205959   | 08-04-20 |
| Antenna, Horn, 18 GHz                 | ETS           | 3117                   | 00168717   | 08-04-20 |
| Combiner                              | WEINSCHTEL    | 1575                   | 2150       | 08-08-19 |
| Communications Test Set               | R&S           | CMW500                 | 115331     | 08-07-19 |
| DC Power Supply                       | Agilent / HP  | E3640A                 | MY54226395 | 08-06-19 |
| Preamplifier, 1000 MHz                | Sonoma        | 310N                   | 341282     | 08-07-19 |
| Preamplifier, 1000 MHz                | Sonoma        | 310N                   | 370599     | 08-06-19 |
| Preamplifier, 1000 MHz                | Sonoma        | 310N                   | 351741     | 08-07-19 |
| Preamplifier, 18 GHz                  | Miteq         | AFS42-00101800-25-S-42 | 1876511    | 08-07-19 |
| Preamplifier, 18 GHz                  | Miteq         | AFS42-00101800-25-S-42 | 2029169    | 08-07-19 |
| Preamplifier, 18 GHz                  | Miteq         | AFS42-00101800-25-S-42 | 1896138    | 08-07-19 |
| Spectrum Analyzer, 44 GHz             | Agilent / HP  | N9030A                 | MY54490312 | 08-06-19 |
| EMI Test Receive, 40 GHz              | R&S           | ESU40                  | 100439     | 08-06-19 |
| EMI Test Receive, 40 GHz              | R&S           | ESU40                  | 100457     | 08-06-19 |
| Directional Antenna                   | Cobham        | FPA3-0.8-6.0R/1329     | 80108-0004 | N/A      |
| High Pass Filter 1.2GHz               | Micro-Tronics | HPM50108-02            | G005       | 08-08-19 |
| High Pass Filter 1.2GHz               | Micro-Tronics | HPM50108-02            | G006       | 08-08-19 |
| High Pass Filter 2.8GHz               | Micro-Tronics | HPM50111-02            | 010        | 08-08-19 |
| High Pass Filter 2.8GHz               | Micro-Tronics | HPM50111-02            | 011        | 08-08-19 |
| High Pass Filter 4GHz                 | Micro-Tronics | HPM50118-02            | G001       | 08-08-19 |
| High Pass Filter 4GHz                 | Micro-Tronics | HPM50118-02            | G002       | 08-08-19 |
| Attenuator                            | PASTERNAK     | PE7087-10              | A009       | 08-08-19 |
| Attenuator                            | PASTERNAK     | PE7087-10              | A001       | 08-08-19 |
| Attenuator                            | PASTERNAK     | PE7087-10              | A008       | 08-08-19 |
| Attenuator                            | PASTERNAK     | PE7087-10              | 2          | 08-07-19 |
| Attenuator                            | PASTERNAK     | PE7395-10              | A011       | 08-08-19 |
| Antenna, Loop, 9kHz-30MHz             | R&S           | HFH2-Z2                | 100418     | 10-26-19 |
| Temperature Chamber                   | ESPEC         | SH-642                 | 93001109   | 08-06-19 |
| UL Software                           |               |                        |            |          |
| Description                           | Manufacturer  | Model                  | Version    |          |
| Antenna port test software            | UL            | CLT                    | Ver 2.5    |          |

## 7. SUMMARY TABLE

| FCC Part Section | Test Description                    | Test Limit  | Test Condition | Test Result |
|------------------|-------------------------------------|-------------|----------------|-------------|
| 2.1049           | Occupied Band width (99%)           | N/A         | Conducted      | Pass        |
| 27.53(m)         | Conducted Spurious Emission         | -25 dBm     |                | Pass        |
| 27.53(m)         | Emission mask                       | Section 7.2 |                | Pass        |
| 2.1046           | Conducted output power              | N/A         |                | Pass        |
| 27.50(h)(2)      | Equivalent Isotropic Radiated Power | 33dBm       | Radiated       | Pass        |
| 27.53 (m)        | Radiated Spurious Emission          | -25dBm      |                | Pass        |

## 7. LIMITS AND CONDUCTED RESULTS

### 7.1. OCCUPIED BANDWIDTH

#### RULE PART(S)

FCC: §2.1049

#### LIMITS

For reporting purposes only

#### TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

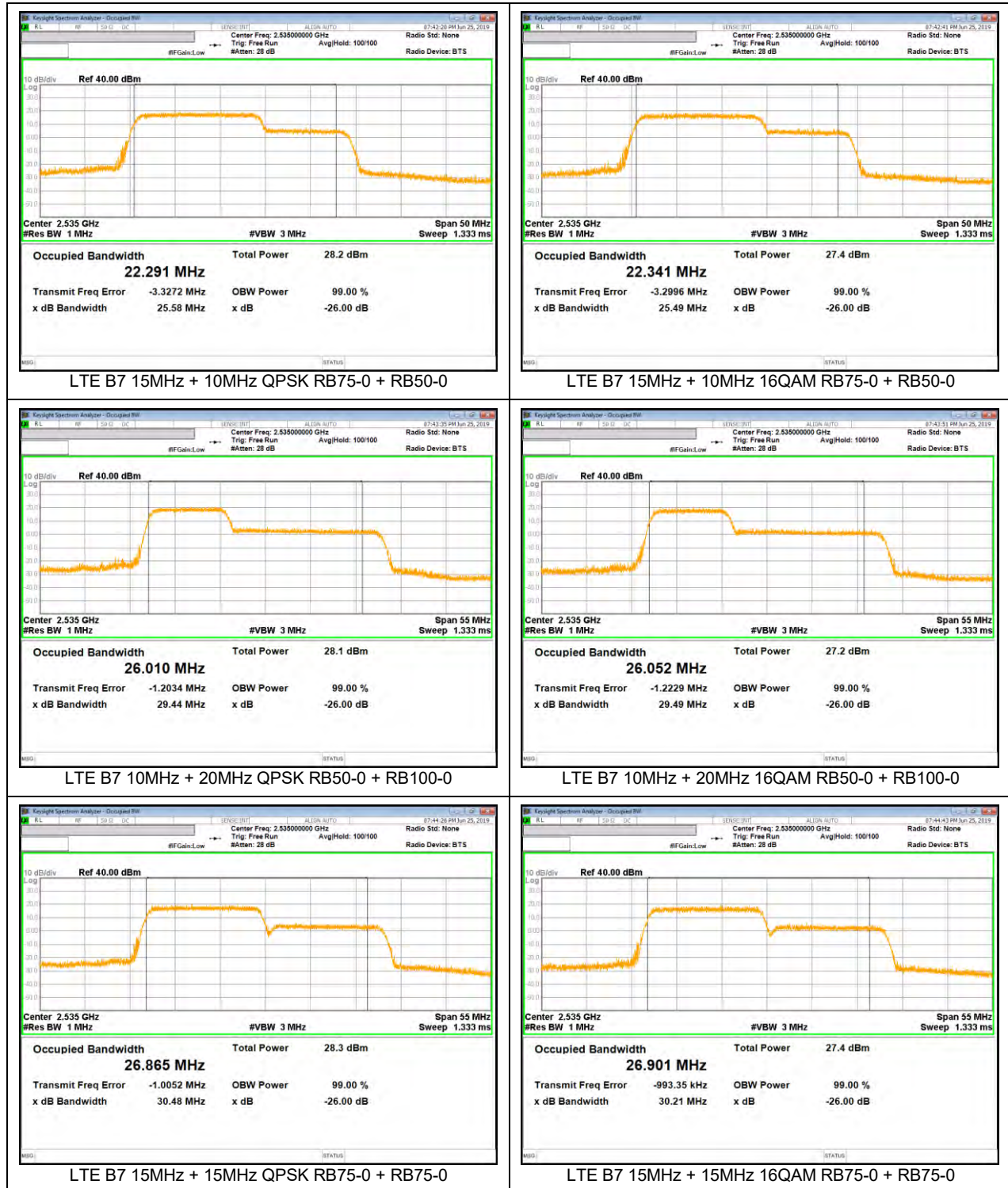
(KDB 971168 D01 Power Meas License Digital Systems v03r01)

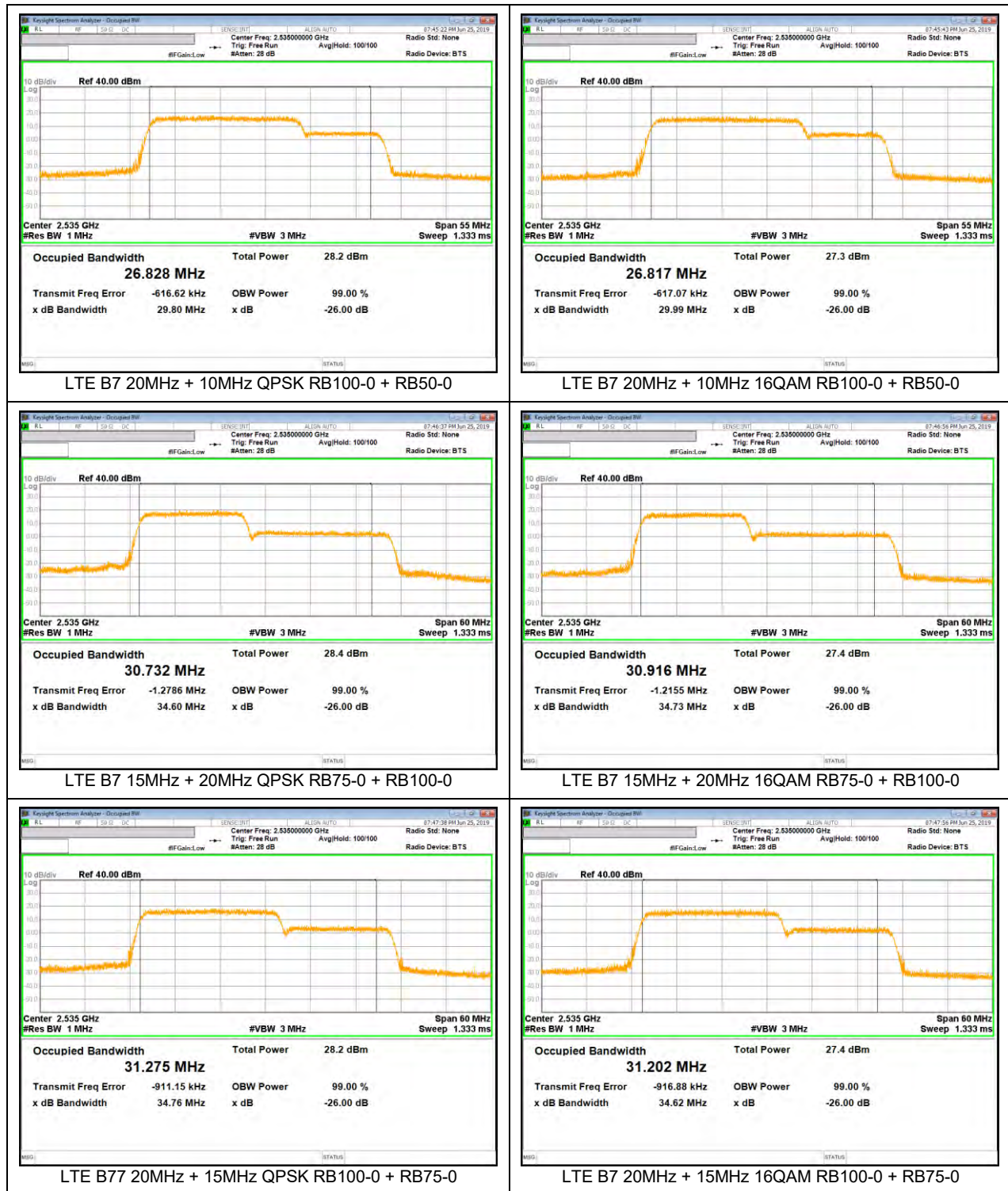
#### RESULTS

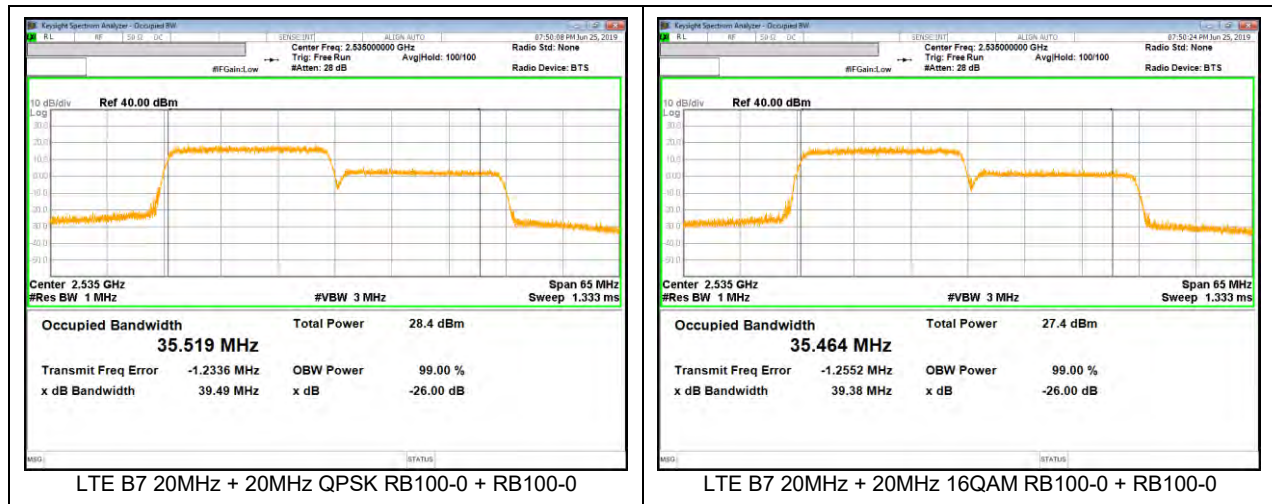
See the following pages.

## 7.1.1. OCCUPIED BANDWIDTH RESULTS

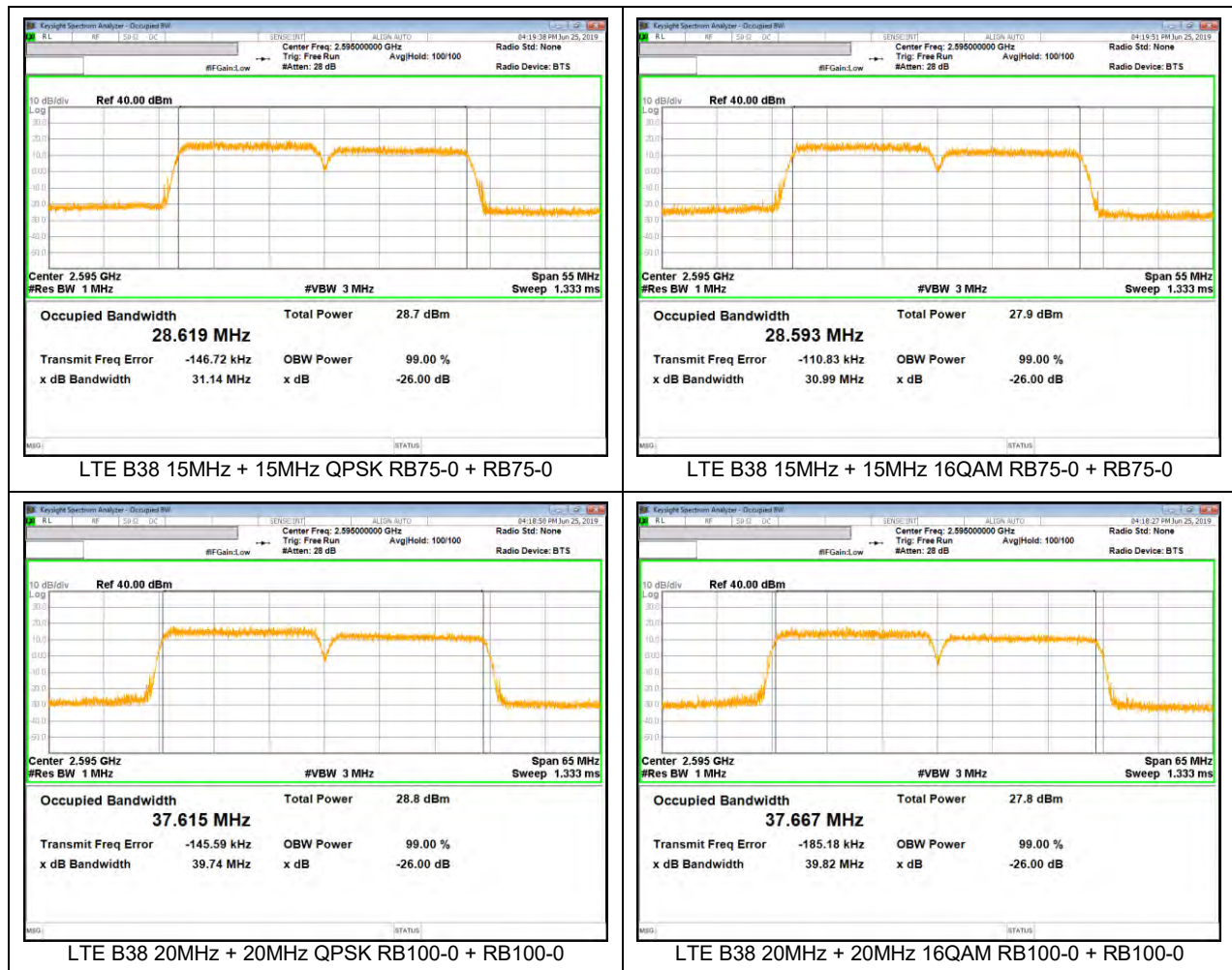
### LTE Band 7C (UL CA)







### LTE Band 38C (UL CA)



## 7.2. EMISSION MASK

### RULE PART(S)

FCC: §27. 53

### LIMITS

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

(m) (4) For mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log (P)$  dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than  $43 + 10 \log (P)$  dB on all frequencies between 2490.5 MHz and 2496 MHz and  $55 + 10 \log (P)$  dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

### TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

### NOTE1

LTE Band 38 - Duty cycle correction factor(2.22dB) already applied on the plot.

### NOTE2

Note that the spurious emissions outside of the channel include narrowband signals. These signals are all below the -13dBm / -25dBm limits. Although the measurement bandwidth is less than the reference bandwidth of 1MHz no addental correction is applied as ANSI C63.26 section 4.2.3 only requires the correction to be applied when the OBW of the emission being measured is wider than the measurement bandwidth (Where the OBW of the signal under measurement is less than the RBW of the measuring instrument, no bandwidth correction or integration will be required.) Plots for low and high channels show the level of the emission measured with the reduced bandwidth and the level of the same emission measured using the integration method over the 1MHz reference bandwidth are very close, indicating the emissions are narrowband.

### RESULTS

See the following pages.

**LTE 7**

| Bandwidth             | Mode  | Ch.  | RB Status | Side Trace    | Level [dBm] | Limit [dBm] |
|-----------------------|-------|------|-----------|---------------|-------------|-------------|
| 15 MHz<br>/<br>10 MHz | QPSK  | Low  | 1RB       | Lower Trace 1 | -36.58      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -47.04      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -64.06      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -20.55      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -24.67      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -31.75      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -45.36      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -45.13      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -51.91      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -30.37      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -34.17      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -51.45      | -25.00      |
|                       | 16QAM | Low  | 1RB       | Lower Trace 1 | -36.56      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -46.78      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.55      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -23.29      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -27.33      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -34.61      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -46.22      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -44.81      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -51.78      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -33.93      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -37.50      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -51.45      | -25.00      |

**LTE 7(Continue)**

| Bandwidth             | Mode  | Ch.  | RB Status | Side Trace    | Level [dBm] | Limit [dBm] |
|-----------------------|-------|------|-----------|---------------|-------------|-------------|
| 10 MHz<br>/<br>20 MHz | QPSK  | Low  | 1RB       | Lower Trace 1 | -36.91      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -46.64      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.19      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -21.84      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -26.30      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -33.40      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -48.46      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -47.80      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.34      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -35.19      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -38.92      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.29      | -25.00      |
|                       | 16QAM | Low  | 1RB       | Lower Trace 1 | -36.42      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -46.41      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.35      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -24.60      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -30.30      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -36.63      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -48.39      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -47.74      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.35      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -37.79      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -40.73      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.31      | -25.00      |

**LTE 7(Continue)**

| Bandwidth             | Mode  | Ch.  | RB Status | Side Trace    | Level [dBm] | Limit [dBm] |
|-----------------------|-------|------|-----------|---------------|-------------|-------------|
| 15 MHz<br>/<br>15 MHz | QPSK  | Low  | 1RB       | Lower Trace 1 | -28.72      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -46.88      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.75      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -20.64      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -25.17      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -31.58      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -41.28      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -47.78      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.37      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -32.16      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -34.74      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.40      | -25.00      |
|                       | 16QAM | Low  | 1RB       | Lower Trace 1 | -29.63      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -46.62      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -51.12      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -23.53      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -28.88      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -35.05      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -42.46      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -47.72      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.29      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -34.43      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -37.55      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.31      | -25.00      |

**LTE 7(Continue)**

| Bandwidth             | Mode  | Ch.  | RB Status | Side Trace    | Level [dBm] | Limit [dBm] |
|-----------------------|-------|------|-----------|---------------|-------------|-------------|
| 20 MHz<br>/<br>10 MHz | QPSK  | Low  | 1RB       | Lower Trace 1 | -39.48      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -47.66      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.81      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -24.90      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -27.73      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -32.66      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -46.88      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -46.51      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.33      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -30.95      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -33.44      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.28      | -25.00      |
|                       | 16QAM | Low  | 1RB       | Lower Trace 1 | -39.09      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -47.53      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -51.04      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -28.43      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -31.59      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -36.19      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -46.57      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -47.23      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.30      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -33.72      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -36.36      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.39      | -25.00      |

**LTE 7(Continue)**

| Bandwidth             | Mode  | Ch.  | RB Status | Side Trace    | Level [dBm] | Limit [dBm] |
|-----------------------|-------|------|-----------|---------------|-------------|-------------|
| 15 MHz<br>/<br>20 MHz | QPSK  | Low  | 1RB       | Lower Trace 1 | -34.36      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -46.74      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.39      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -20.67      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -24.96      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -30.75      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -48.62      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -48.01      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.26      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -34.90      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -37.72      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.33      | -25.00      |
|                       | 16QAM | Low  | 1RB       | Lower Trace 1 | -34.31      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -46.57      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.46      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -26.41      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -32.15      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -45.64      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -48.53      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -47.96      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.29      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -37.46      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -39.52      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -41.40      | -25.00      |

**LTE 7(Continue)**

| Bandwidth             | Mode  | Ch.  | RB Status | Side Trace    | Level [dBm] | Limit [dBm] |
|-----------------------|-------|------|-----------|---------------|-------------|-------------|
| 20 MHz<br>/<br>15 MHz | QPSK  | Low  | 1RB       | Lower Trace 1 | -38.67      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -47.39      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.65      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -24.24      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -27.72      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -32.95      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -46.48      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -47.91      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.29      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -33.90      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -36.89      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.36      | -25.00      |
|                       | 16QAM | Low  | 1RB       | Lower Trace 1 | -38.22      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -47.26      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.88      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -27.46      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -30.69      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -35.68      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -47.23      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -47.80      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.31      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -36.69      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -39.26      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.33      | -25.00      |

**LTE 7(Continue)**

| Bandwidth             | Mode  | Ch.  | RB Status | Side Trace    | Level [dBm] | Limit [dBm] |
|-----------------------|-------|------|-----------|---------------|-------------|-------------|
| 20 MHz<br>/<br>20 MHz | QPSK  | Low  | 1RB       | Lower Trace 1 | -37.59      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -47.31      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.49      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -23.93      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -27.14      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -31.58      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -48.01      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -48.89      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.31      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -35.59      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -36.93      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.22      | -25.00      |
|                       | 16QAM | Low  | 1RB       | Lower Trace 1 | -36.91      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -47.12      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -50.61      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -26.90      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -29.99      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -34.55      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -48.34      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -48.77      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.24      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -36.70      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -38.32      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -52.32      | -25.00      |

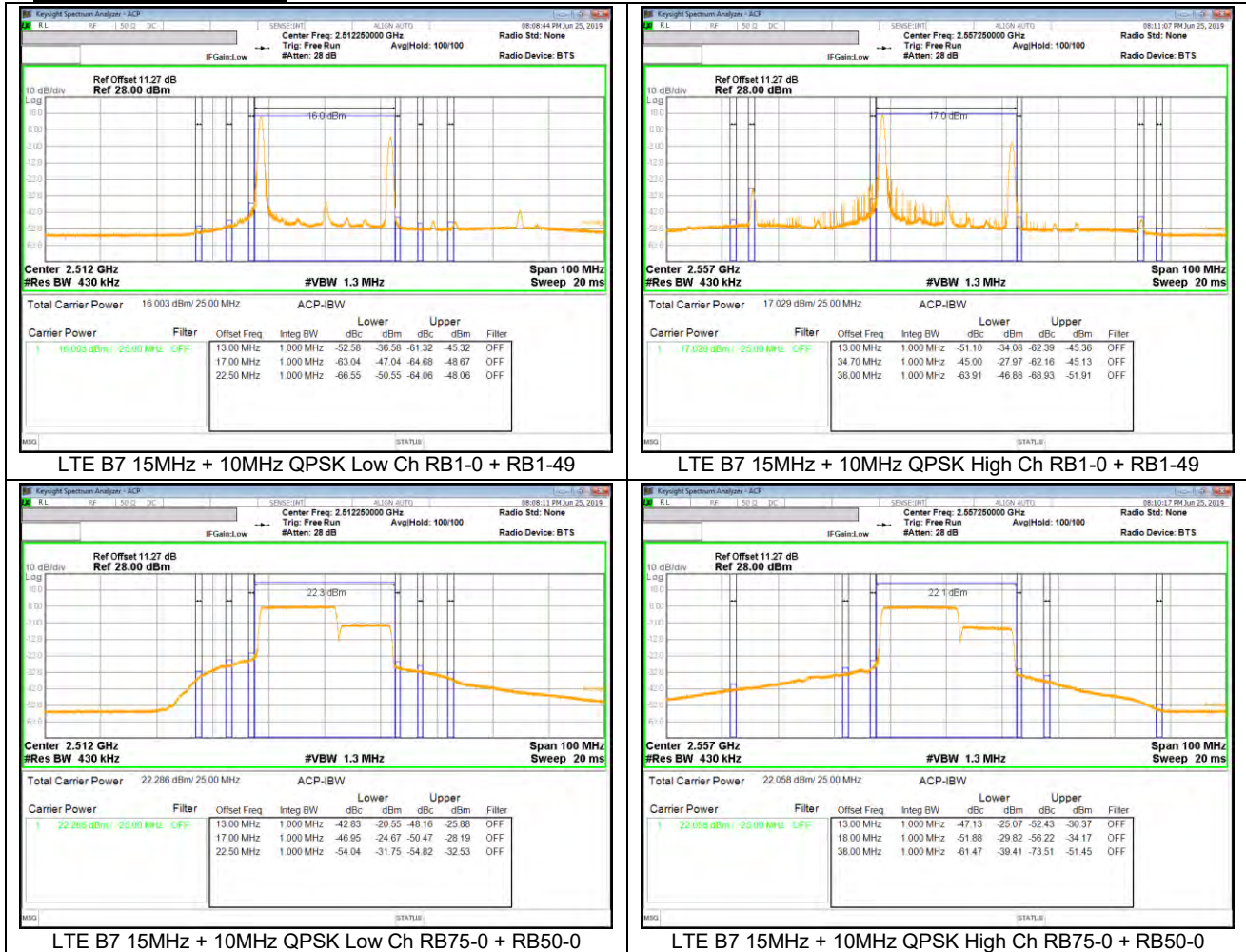
**LTE 38**

| Bandwidth             | Mode  | Ch.  | RB Status | Side Trace    | Level [dBm] | Limit [dBm] |
|-----------------------|-------|------|-----------|---------------|-------------|-------------|
| 15 MHz<br>/<br>15 MHz | QPSK  | Low  | 1RB       | Lower Trace 1 | -29.11      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -24.83      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -47.69      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -24.94      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -29.16      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -40.84      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -32.39      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -25.74      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -48.97      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -31.13      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -37.59      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -42.44      | -25.00      |
|                       | 16QAM | Low  | 1RB       | Lower Trace 1 | -29.36      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -24.16      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -47.90      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -26.50      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -31.30      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -40.44      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -33.65      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -26.28      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -48.96      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -30.86      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -38.39      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -42.98      | -25.00      |

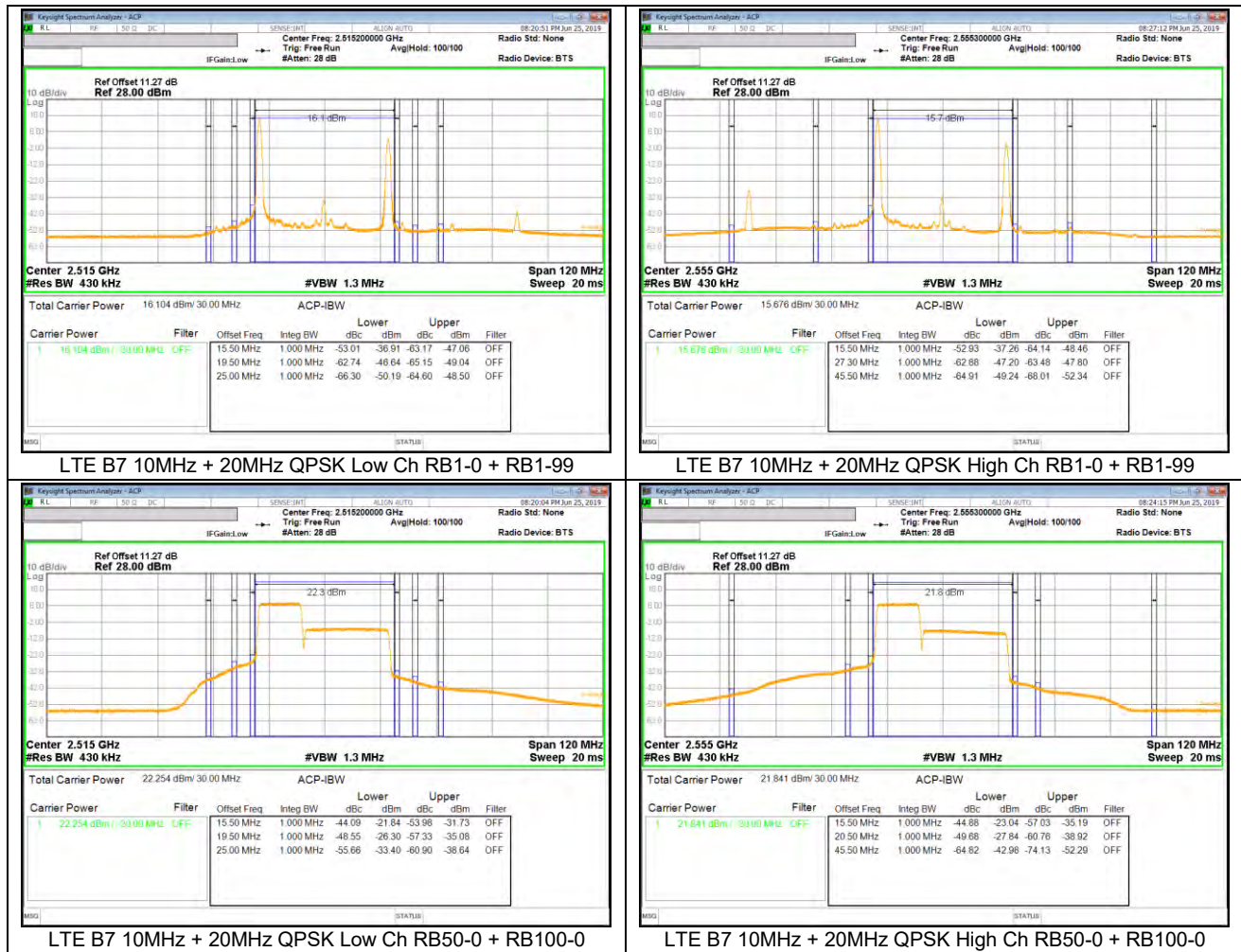
**LTE 38(Continue)**

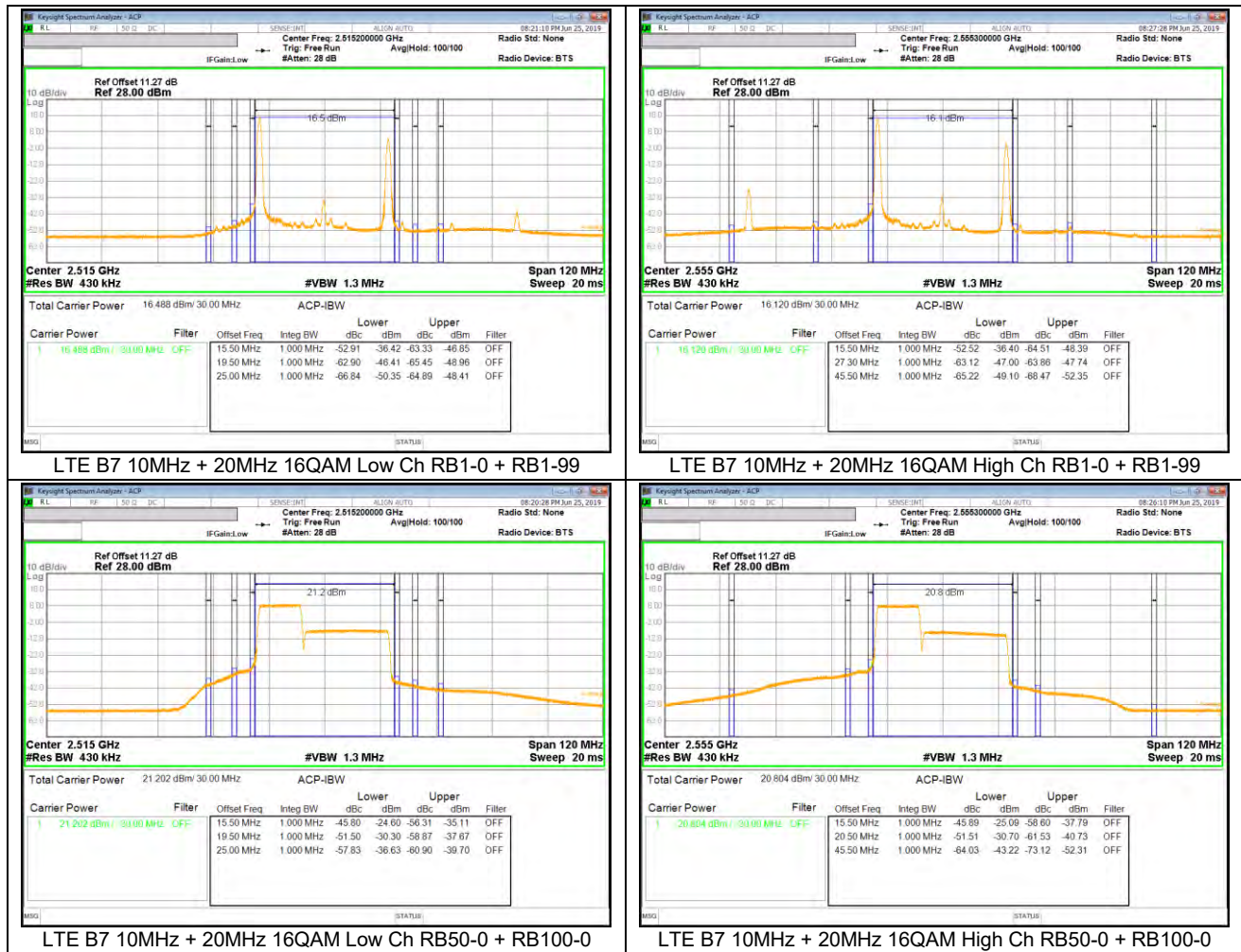
| Bandwidth             | Mode  | Ch.  | RB Status | Side Trace    | Level [dBm] | Limit [dBm] |
|-----------------------|-------|------|-----------|---------------|-------------|-------------|
| 20 MHz<br>/<br>20 MHz | QPSK  | Low  | 1RB       | Lower Trace 1 | -38.05      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -24.72      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -49.54      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -30.49      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -33.64      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -43.77      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -42.14      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -27.52      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -49.76      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -32.07      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -34.08      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -45.05      | -25.00      |
|                       | 16QAM | Low  | 1RB       | Lower Trace 1 | -38.71      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -24.47      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -49.55      | -25.00      |
|                       |       |      | FRB       | Lower Trace 1 | -30.82      | -10.00      |
|                       |       |      |           | Lower Trace 2 | -35.60      | -13.00      |
|                       |       |      |           | Lower Trace 3 | -44.75      | -25.00      |
|                       |       | High | 1RB       | Upper Trace 1 | -41.25      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -26.84      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -49.77      | -25.00      |
|                       |       |      | FRB       | Upper Trace 1 | -34.25      | -10.00      |
|                       |       |      |           | Upper Trace 2 | -36.35      | -13.00      |
|                       |       |      |           | Upper Trace 3 | -46.41      | -25.00      |

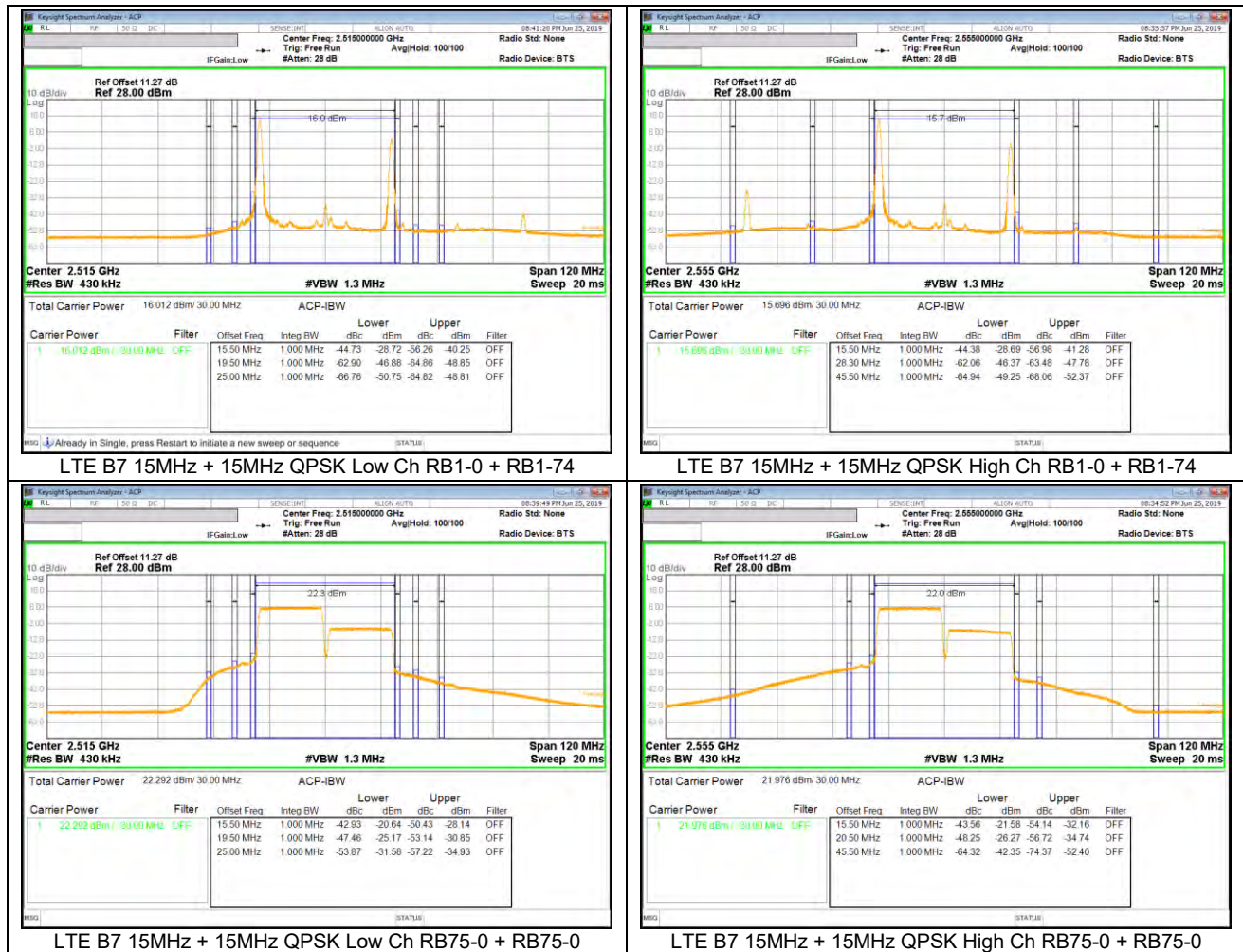
# LTE Band 7C(UL CA)

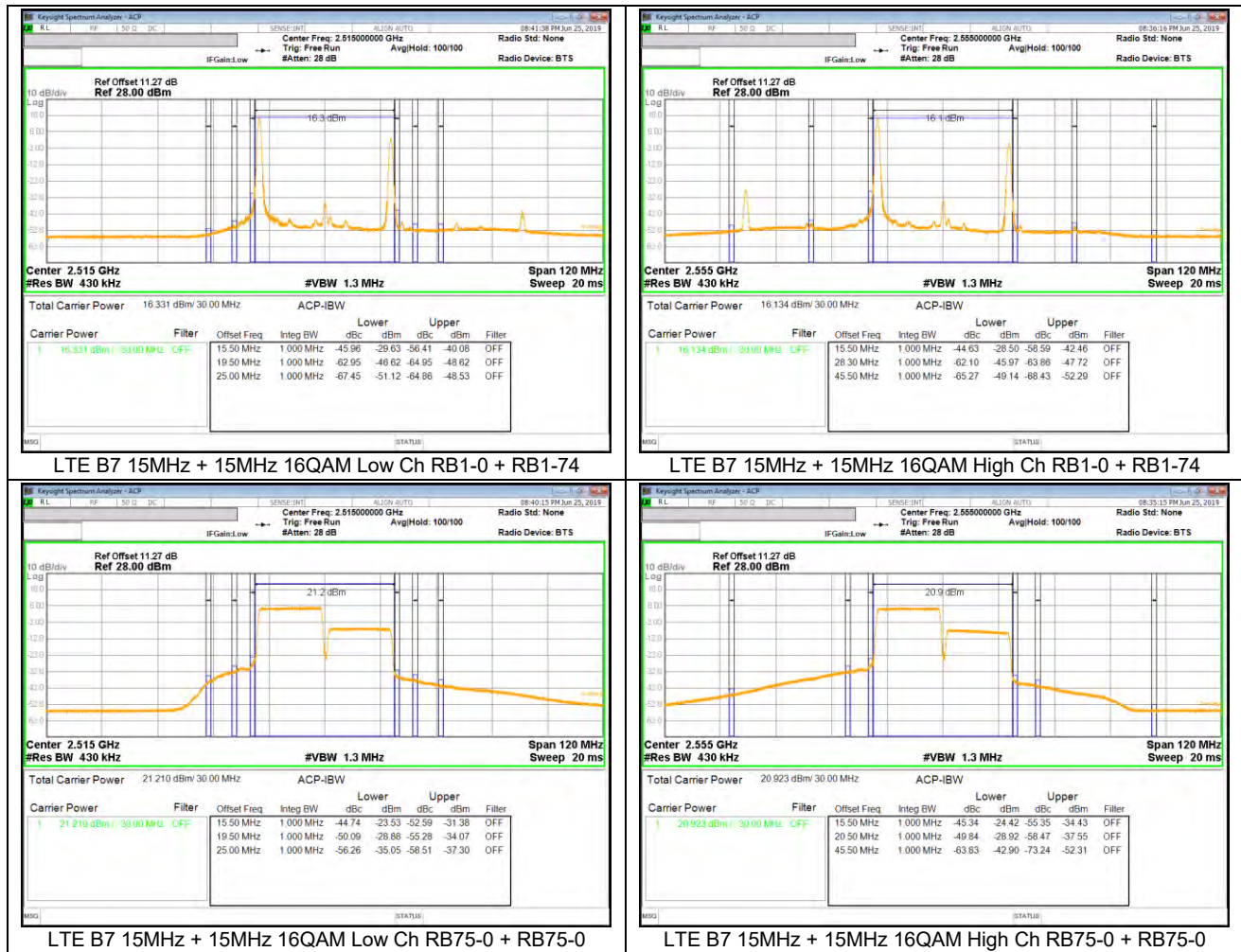


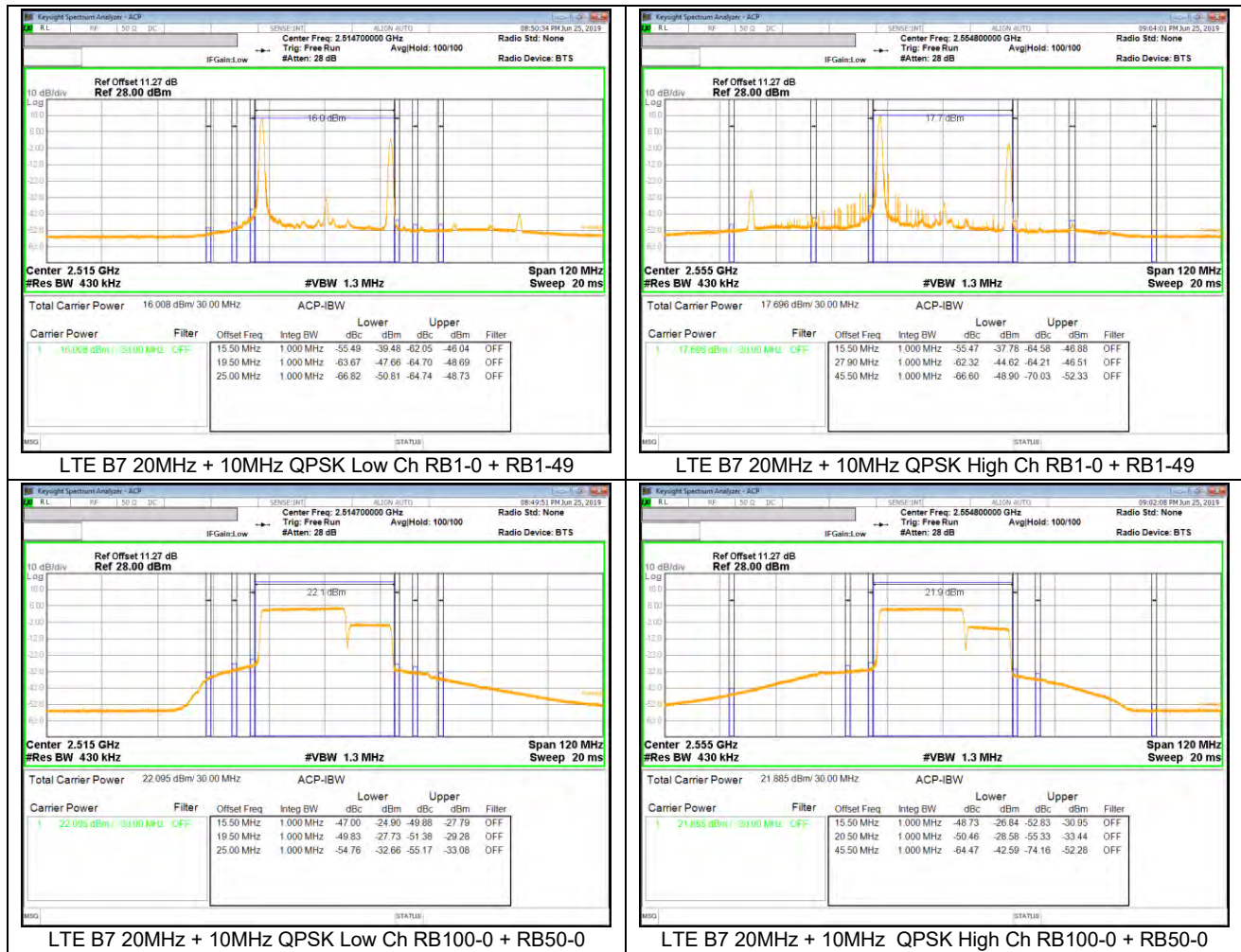


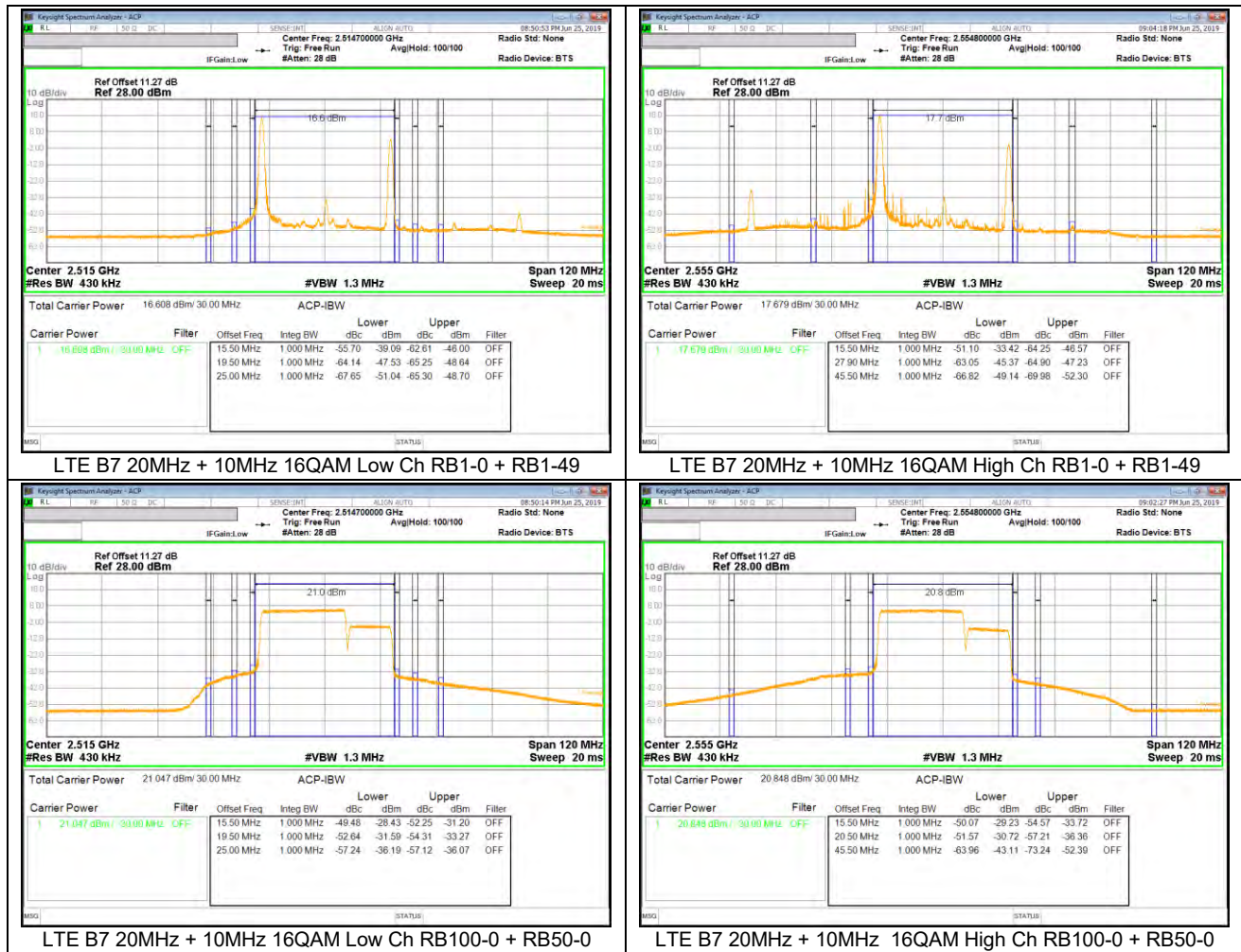


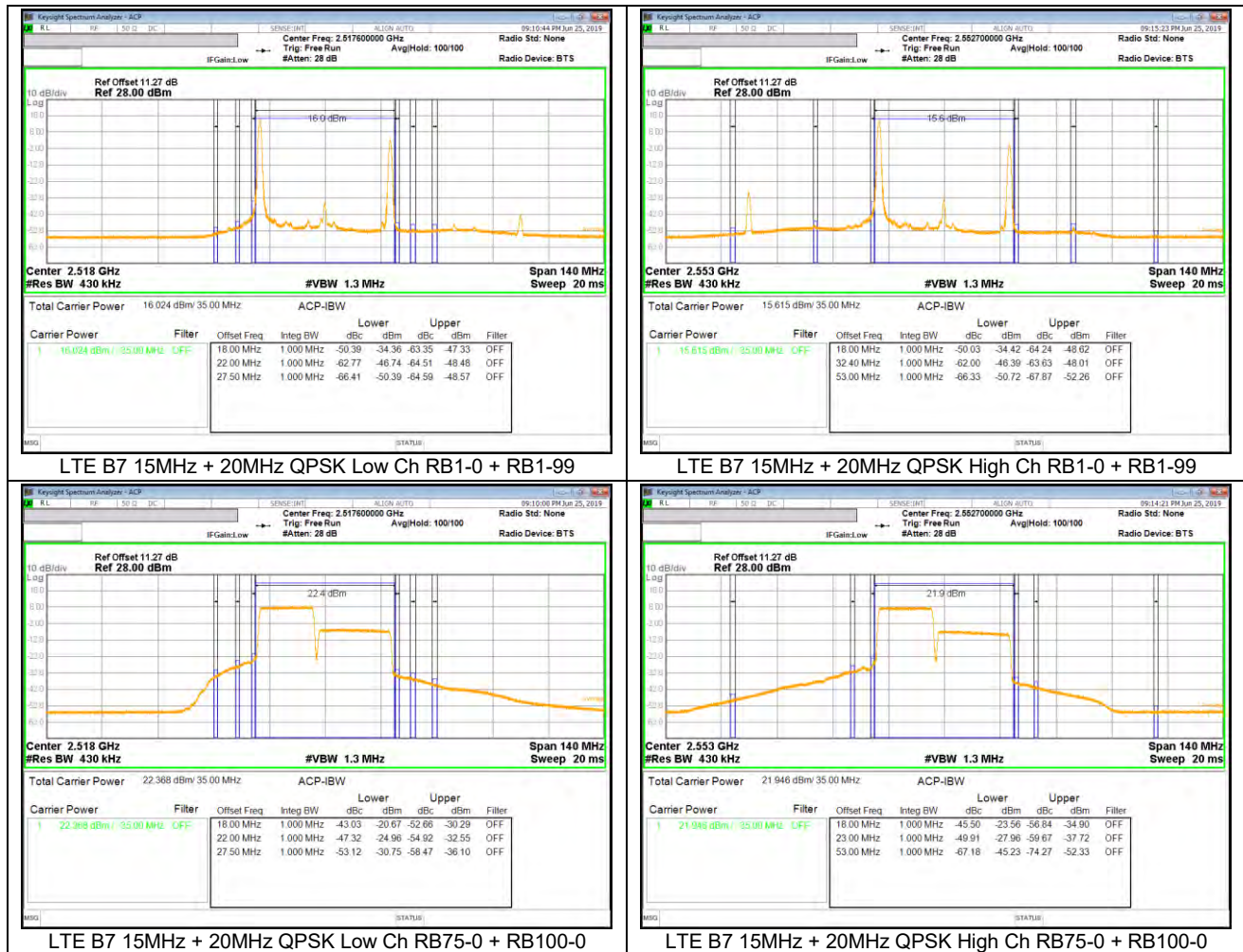


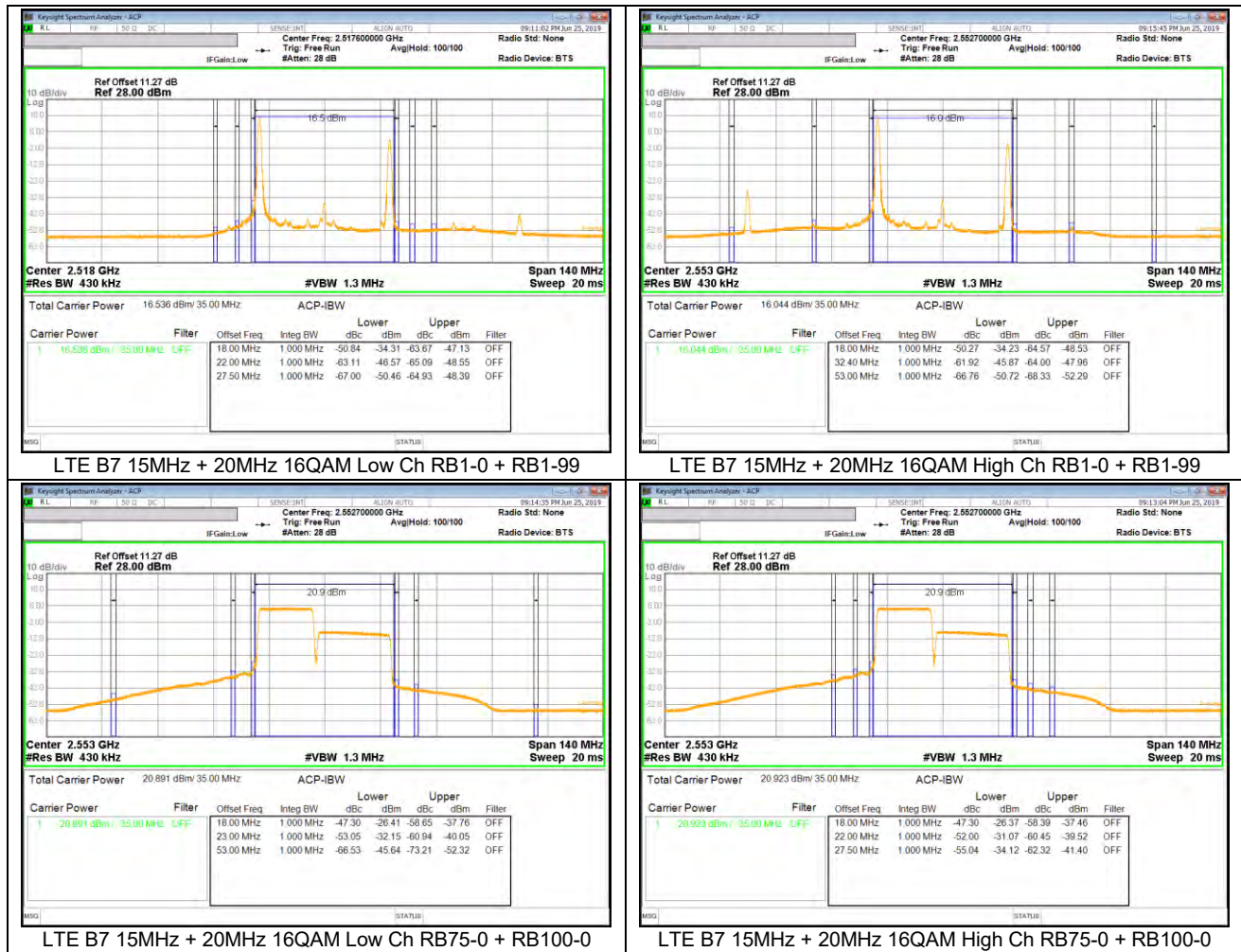


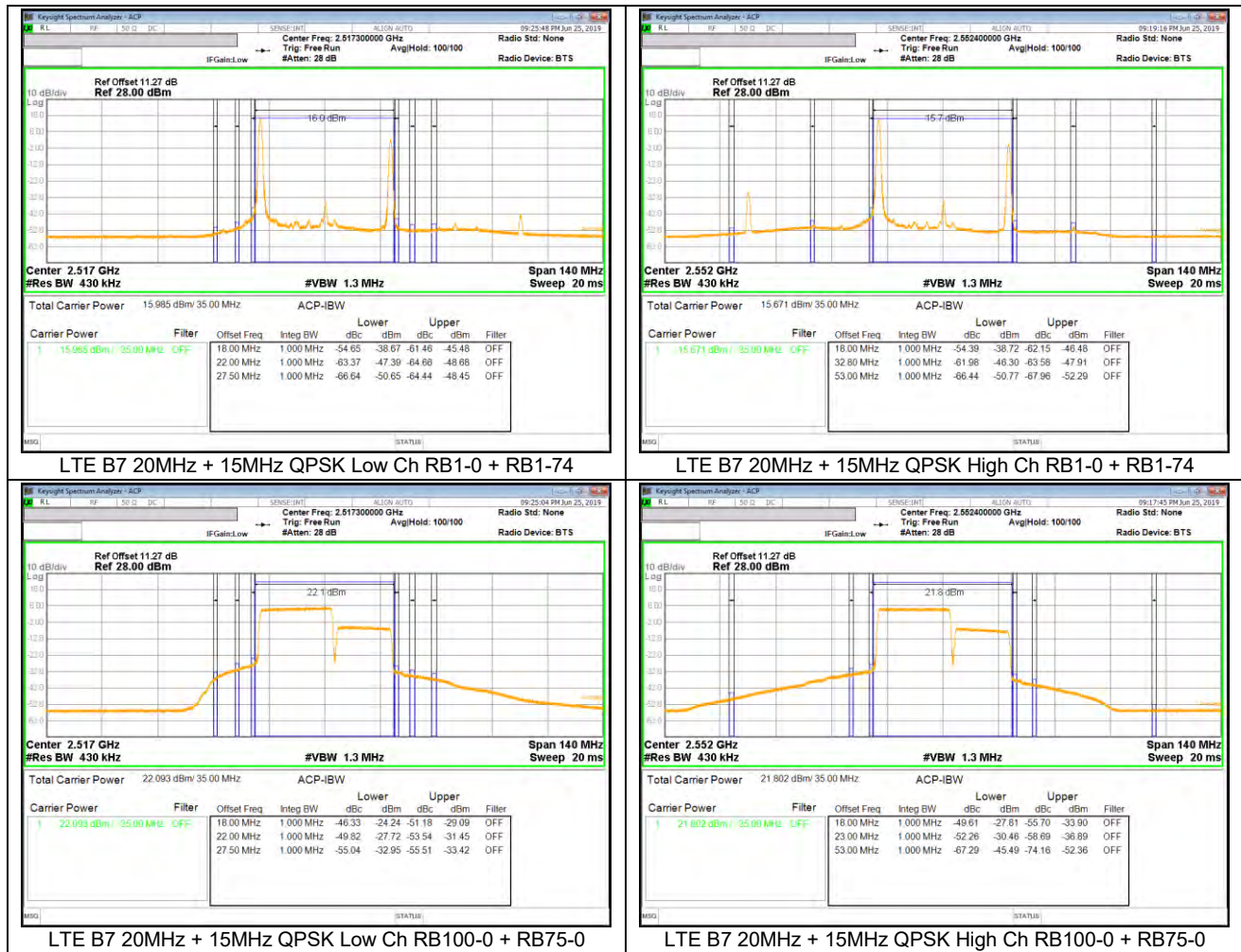


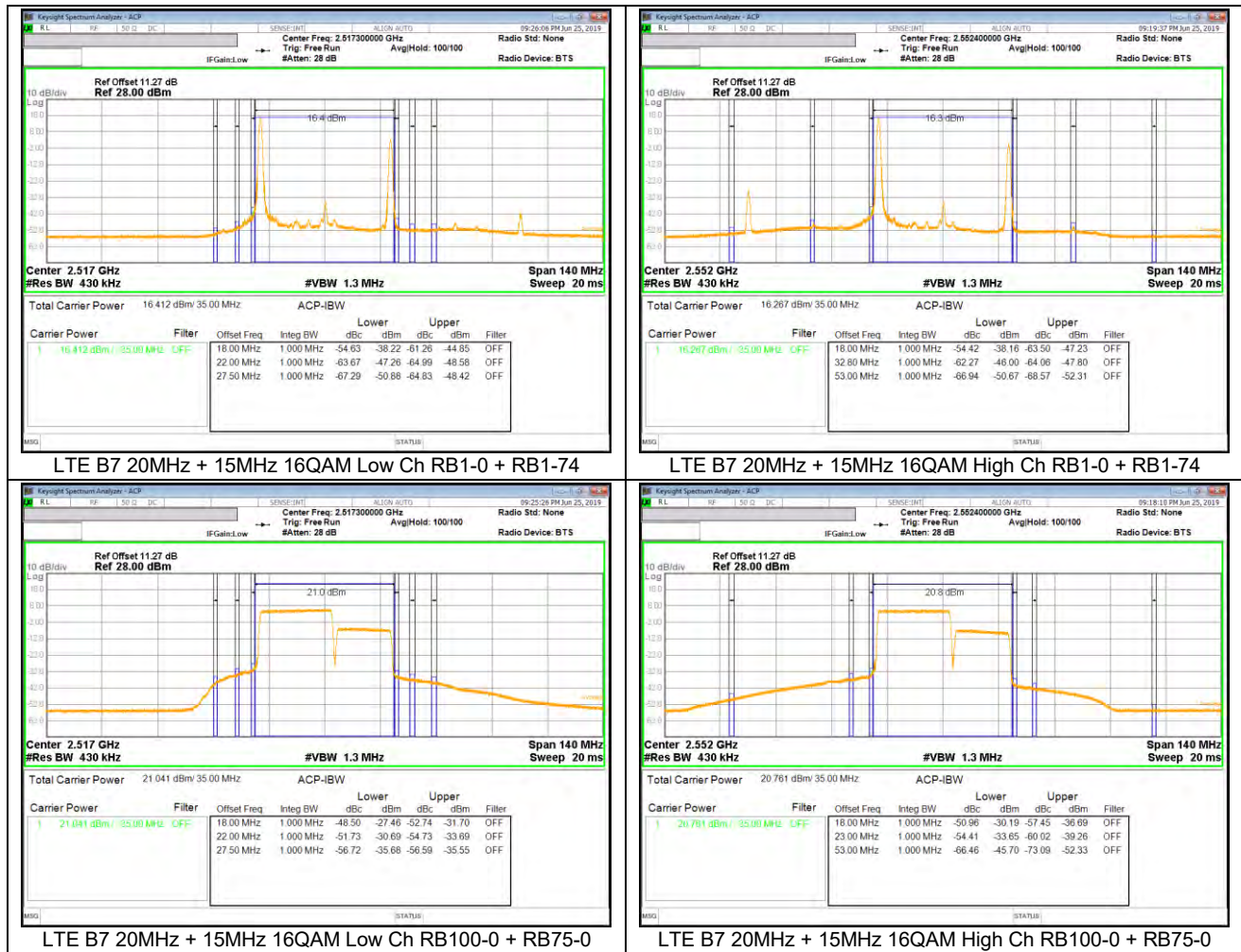


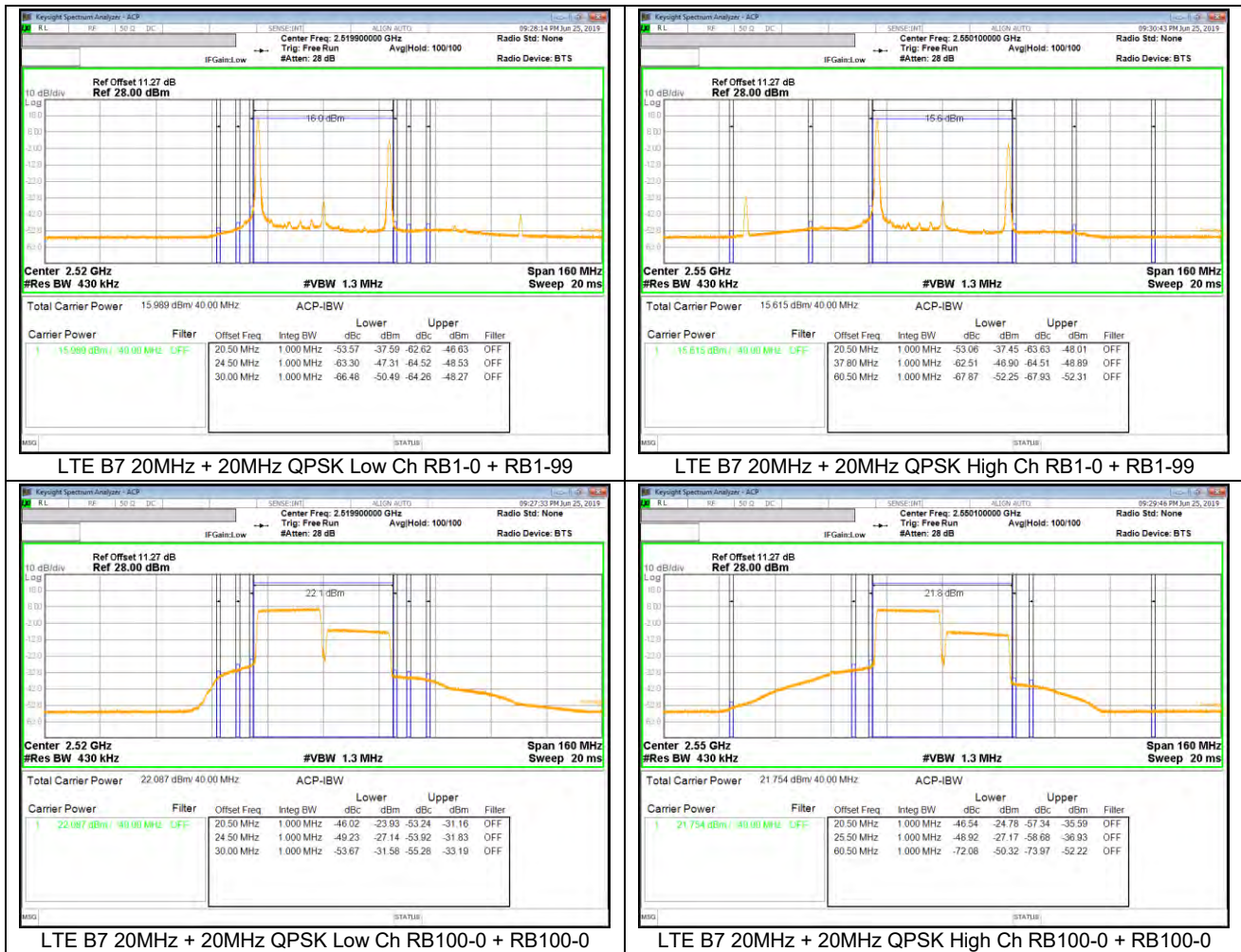


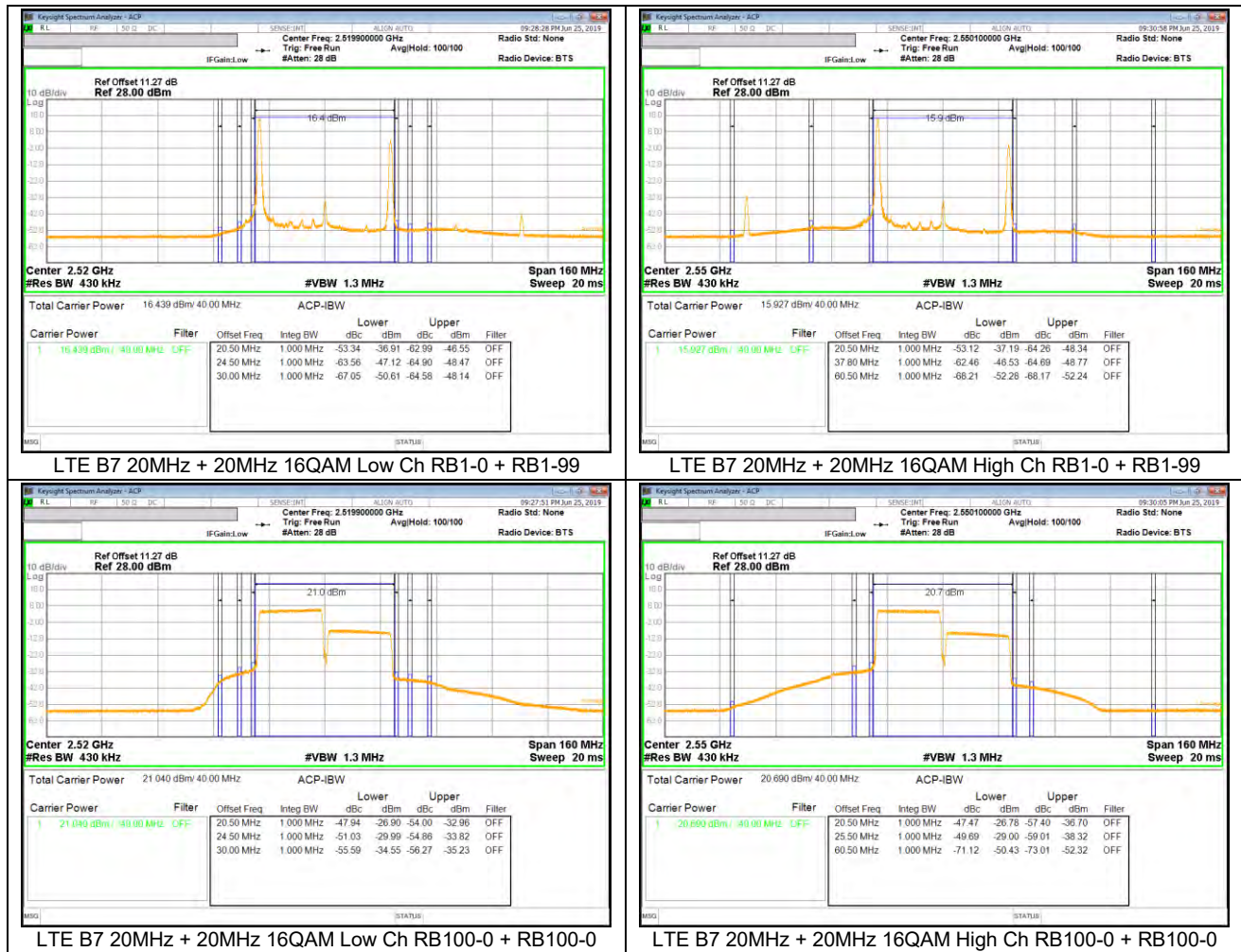




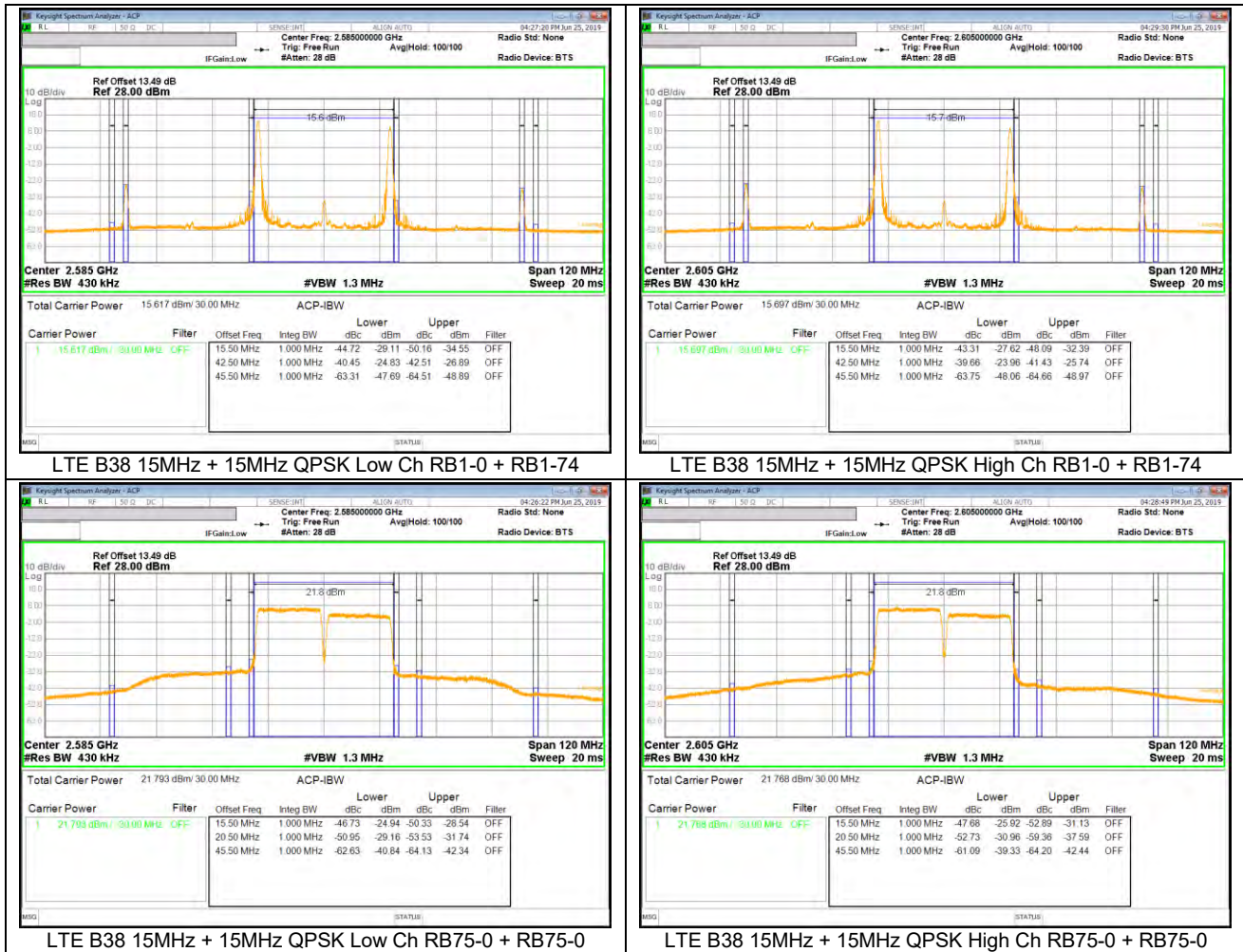


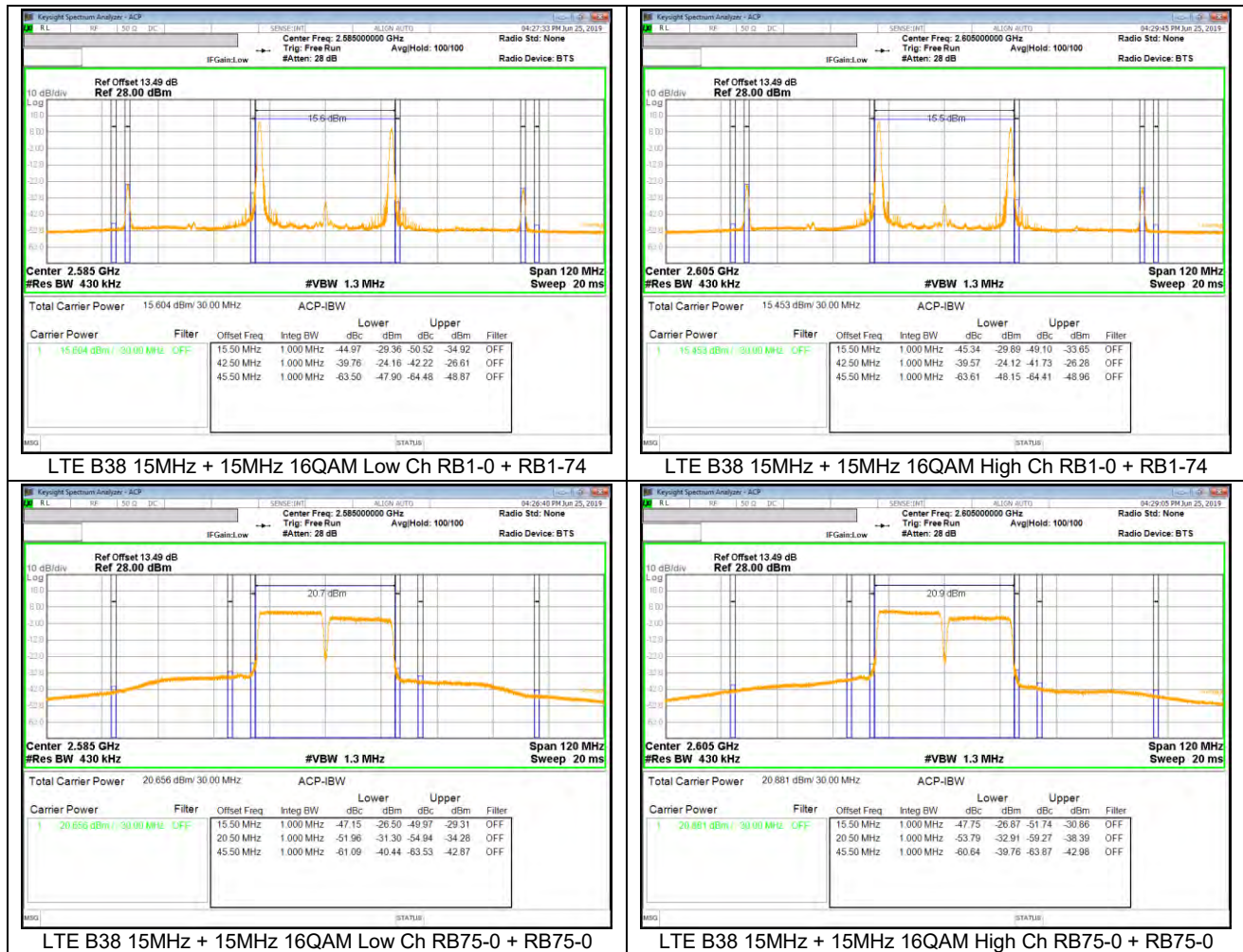


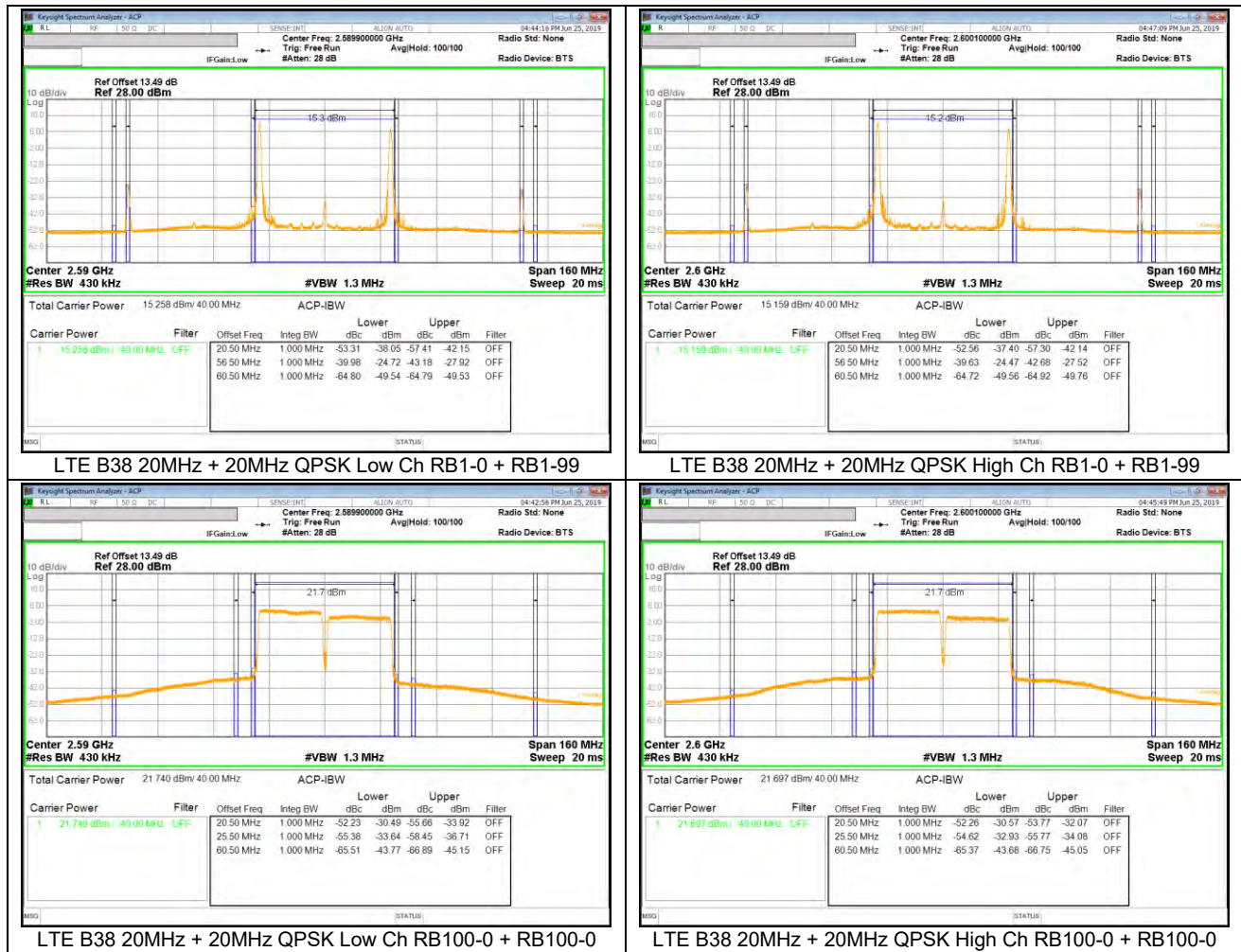


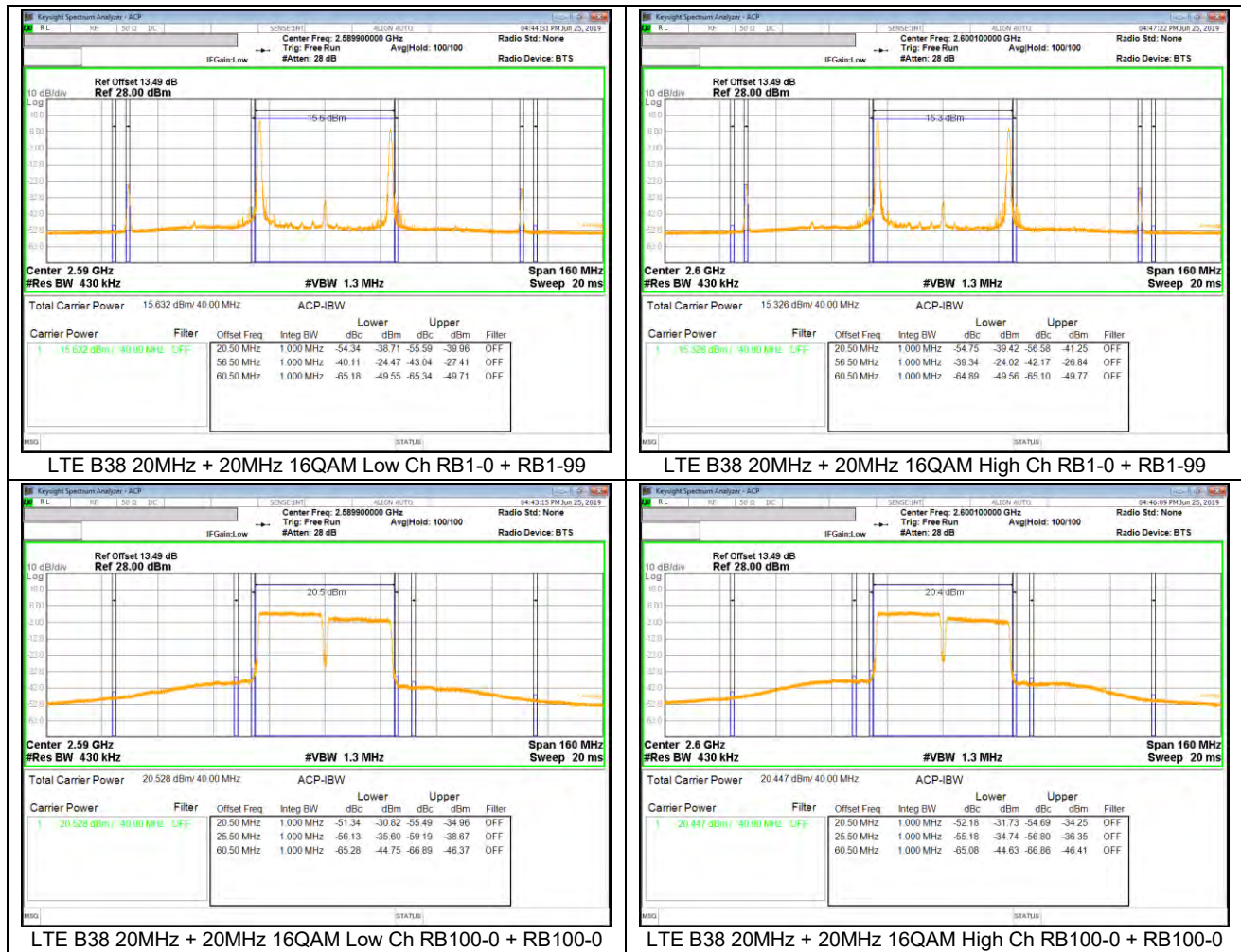


**LTE Band 38C(UL CA)**









### 7.3. OUT OF BAND EMISSIONS

#### RULE PART(S)

FCC: §27.53

#### LIMITS

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

Part 27.53:

(m) (4) For mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log (P)$  dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than  $43 + 10 \log (P)$  dB on all frequencies between 2490.5 MHz and 2496 MHz and  $55 + 10 \log (P)$  dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

#### TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

- a) Set the RBW = 100KHz for emission below 1GHz and 1MHz for emissions above 1GHz  
(Tests were performed 1MHz [Worst case], to sweep 1 time for all frequency range)
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 1.5$  times the OBW;
- d) Sweep time = auto couple;
- e) Detector = rms;
- f) Ensure that the number of measurement points = Max (40001);
- g) Trace mode = average(LTE Band 7), Maxhold(LTE Band 38);

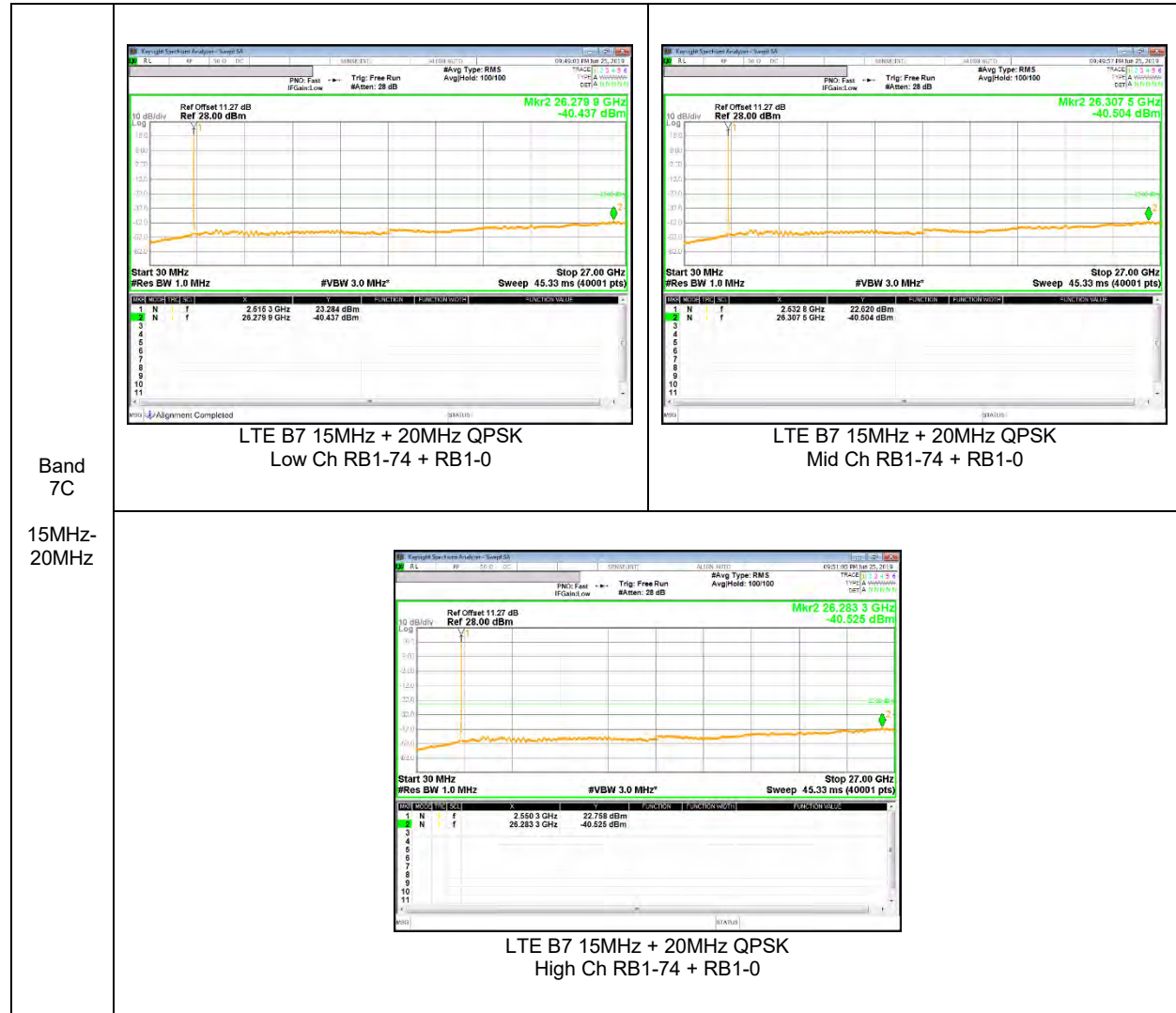
#### RESULTS

See the following pages.

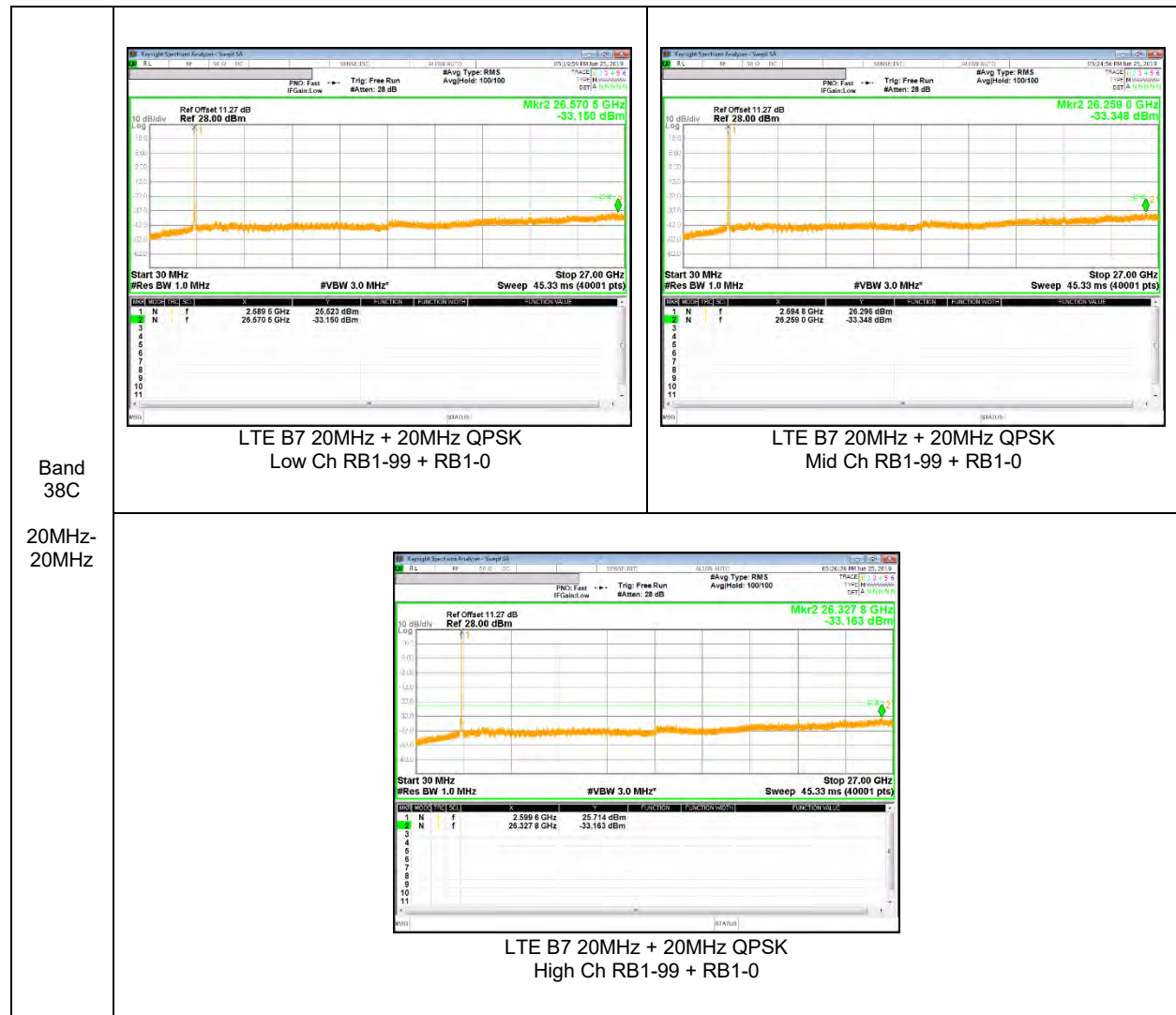
NOTE : Please refer to section 5.5 for bandwidth and RB setting about LTE bands.

### 7.3.1. OUT OF BAND EMISSIONS RESULT

#### LTE Band 7C(UL CA)



**LTE Band 38C(UL CA)**



## 8. RADIATED TEST RESULTS

### 8.1. FIELD STRENGTH OF SPURIOUS RADIATION

#### RULE PART(S)

FCC: §2.1053, §27.53

#### LIMIT

Part 27.53:

(m) (4) For mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log (P)$  dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than  $43 + 10 \log (P)$  dB on all frequencies between 2490.5 MHz and 2496 MHz and  $55 + 10 \log (P)$  dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

#### TEST PROCEDURE

ANSI / TIA / EIA 603 E Clause 2.2.12; ESU40 setting reference to 971168 D01 v03r01

For peak power measurement with a ESU40:

- a) Set the RBW = 100 KHz for emission below 1GHz and 1MHz for emissions above 1GHz
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 1.5$  times the OBW;
- d) Sweep time = auto couple;
- e) Detector = rms;
- f) Ensure that the number of measurement points  $\geq$  span/RBW;
- g) Trace mode = average(LTE Band 7C), Maxhold(LTE Band 38C);;

#### RESULTS

See the following pages.

NOTE : Please refer to section 5.5 for bandwidth and RB setting about LTE bands.

## 8.1.1. SPURIOUS RADIATION PLOTS

### LTE Band 7C

|                                                          |                                                                                                                                                                                                                                                                                                                                                                                     |                     |                    |                 |                |                |               |                |               |       |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------|-----------------|----------------|----------------|---------------|----------------|---------------|-------|
| LTE<br>Band<br>7C<br><br>15MHz<br>-<br>20MHz<br><br>QPSK | <p style="text-align: center;"><b>UL Verification Services, Inc.</b><br/><b>Above 1GHz High Frequency Substitution Measurement</b></p> <p>Company: Samsung<br/>Project #: 4789014604<br/>Date: 2019-06-25<br/>Test Engineer: 45585<br/>Configuration: EUT / AC Adapter, Z-Position<br/>Location: Chamber 1<br/>Mode: LTE_QPSK Band 7 Uplink CA Harmonics, 15MHz/20MHz Bandwidth</p> |                     |                    |                 |                |                |               |                |               |       |
|                                                          | f<br>MHz                                                                                                                                                                                                                                                                                                                                                                            | SG reading<br>(dBm) | Ant. Pol.<br>(H/V) | Distance<br>(m) | Preamp<br>(dB) | Filter<br>(dB) | EIRP<br>(dBm) | Limit<br>(dBm) | Delta<br>(dB) | Notes |
| <b>PCC 2507.8MHz, SCC 2524.9MHz</b>                      |                                                                                                                                                                                                                                                                                                                                                                                     |                     |                    |                 |                |                |               |                |               |       |
|                                                          | 5030.00                                                                                                                                                                                                                                                                                                                                                                             | -16.8               | V                  | 3.0             | 43.8           | 1.0            | -59.6         | -25.0          | -34.6         |       |
|                                                          | 7545.00                                                                                                                                                                                                                                                                                                                                                                             | -14.7               | V                  | 3.0             | 42.4           | 1.0            | -56.1         | -25.0          | -31.1         |       |
|                                                          | 10060.00                                                                                                                                                                                                                                                                                                                                                                            | -12.4               | V                  | 3.0             | 40.6           | 1.0            | -51.9         | -25.0          | -26.9         |       |
|                                                          | 5030.00                                                                                                                                                                                                                                                                                                                                                                             | -16.4               | H                  | 3.0             | 43.8           | 1.0            | -59.2         | -25.0          | -34.2         |       |
|                                                          | 7545.00                                                                                                                                                                                                                                                                                                                                                                             | -15.3               | H                  | 3.0             | 42.4           | 1.0            | -56.8         | -25.0          | -31.8         |       |
|                                                          | 10060.00                                                                                                                                                                                                                                                                                                                                                                            | -5.3                | H                  | 3.0             | 40.6           | 1.0            | -44.9         | -25.0          | -19.9         |       |
| <b>PCC 2525.3MHz, SCC 2542.4MHz</b>                      |                                                                                                                                                                                                                                                                                                                                                                                     |                     |                    |                 |                |                |               |                |               |       |
|                                                          | 5065.00                                                                                                                                                                                                                                                                                                                                                                             | -19.5               | V                  | 3.0             | 43.8           | 1.0            | -62.3         | -25.0          | -37.3         |       |
|                                                          | 7597.50                                                                                                                                                                                                                                                                                                                                                                             | -18.4               | V                  | 3.0             | 42.4           | 1.0            | -59.8         | -25.0          | -34.8         |       |
|                                                          | 10130.00                                                                                                                                                                                                                                                                                                                                                                            | -15.0               | V                  | 3.0             | 40.6           | 1.0            | -54.6         | -25.0          | -29.6         |       |
|                                                          | 5065.00                                                                                                                                                                                                                                                                                                                                                                             | -19.6               | H                  | 3.0             | 43.8           | 1.0            | -62.3         | -25.0          | -37.3         |       |
|                                                          | 7597.50                                                                                                                                                                                                                                                                                                                                                                             | -18.2               | H                  | 3.0             | 42.4           | 1.0            | -59.6         | -25.0          | -34.6         |       |
|                                                          | 10130.00                                                                                                                                                                                                                                                                                                                                                                            | -14.2               | H                  | 3.0             | 40.6           | 1.0            | -53.8         | -25.0          | -28.8         |       |
| <b>PCC 2542.9MHz, SCC 2560.0MHz</b>                      |                                                                                                                                                                                                                                                                                                                                                                                     |                     |                    |                 |                |                |               |                |               |       |
|                                                          | 5100.00                                                                                                                                                                                                                                                                                                                                                                             | -19.5               | V                  | 3.0             | 43.8           | 1.0            | -62.2         | -25.0          | -37.2         |       |
|                                                          | 7650.00                                                                                                                                                                                                                                                                                                                                                                             | -18.4               | V                  | 3.0             | 42.4           | 1.0            | -59.8         | -25.0          | -34.8         |       |
|                                                          | 10200.00                                                                                                                                                                                                                                                                                                                                                                            | -15.9               | V                  | 3.0             | 40.6           | 1.0            | -55.5         | -25.0          | -30.5         |       |
|                                                          | 5100.00                                                                                                                                                                                                                                                                                                                                                                             | -19.5               | H                  | 3.0             | 43.8           | 1.0            | -62.2         | -25.0          | -37.2         |       |
|                                                          | 7650.00                                                                                                                                                                                                                                                                                                                                                                             | -18.4               | H                  | 3.0             | 42.4           | 1.0            | -59.7         | -25.0          | -34.7         |       |
|                                                          | 10200.00                                                                                                                                                                                                                                                                                                                                                                            | -16.0               | H                  | 3.0             | 40.6           | 1.0            | -55.6         | -25.0          | -30.6         |       |

**LTE Band 38C**

| LTE                             | UL Verification Services, Inc.<br>Above 1GHz High Frequency Substitution Measurement                                                                                                                                             |                     |                    |                 |                |                |               |                |               |       |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------|-----------------|----------------|----------------|---------------|----------------|---------------|-------|
|                                 | Company: Samsung<br>Project #: 4789014604<br>Date: 2019-06-26<br>Test Engineer: 45585<br>Configuration: EUT / AC Adapter, Y-Position<br>Location: Chamber 1<br>Mode: LTE_QPSK Band 38 Uplink CA Harmonics, 20MHz/20MHz Bandwidth |                     |                    |                 |                |                |               |                |               |       |
| Band 38C                        | f<br>MHz                                                                                                                                                                                                                         | SG reading<br>(dBm) | Ant. Pol.<br>(H/V) | Distance<br>(m) | Preamp<br>(dB) | Filter<br>(dB) | EIRP<br>(dBm) | Limit<br>(dBm) | Delta<br>(dB) | Notes |
|                                 | PCC 2580.0MHz, SCC 2599.8MHz                                                                                                                                                                                                     |                     |                    |                 |                |                |               |                |               |       |
| 20MHz<br>-<br>20MHz<br><br>QPSK | 5180.00                                                                                                                                                                                                                          | -15.3               | V                  | 3.0             | 43.8           | 1.0            | -58.0         | -25.0          | -33.0         |       |
|                                 | 7770.00                                                                                                                                                                                                                          | -11.2               | V                  | 3.0             | 42.3           | 1.0            | -52.5         | -25.0          | -27.5         |       |
|                                 | 10360.00                                                                                                                                                                                                                         | -12.8               | V                  | 3.0             | 40.7           | 1.0            | -52.5         | -25.0          | -27.5         |       |
|                                 | 5180.00                                                                                                                                                                                                                          | -14.9               | H                  | 3.0             | 43.8           | 1.0            | -57.7         | -25.0          | -32.7         |       |
|                                 | 7770.00                                                                                                                                                                                                                          | -12.1               | H                  | 3.0             | 42.3           | 1.0            | -53.4         | -25.0          | -28.4         |       |
|                                 | 10360.00                                                                                                                                                                                                                         | -12.8               | H                  | 3.0             | 40.7           | 1.0            | -52.5         | -25.0          | -27.5         |       |
|                                 | PCC 2585.1MHz, SCC 2604.9MHz                                                                                                                                                                                                     |                     |                    |                 |                |                |               |                |               |       |
|                                 | 5190.00                                                                                                                                                                                                                          | -15.5               | V                  | 3.0             | 43.8           | 1.0            | -58.3         | -25.0          | -33.3         |       |
|                                 | 7785.00                                                                                                                                                                                                                          | -12.3               | V                  | 3.0             | 42.3           | 1.0            | -53.6         | -25.0          | -28.6         |       |
|                                 | 10380.00                                                                                                                                                                                                                         | -12.6               | V                  | 3.0             | 40.7           | 1.0            | -52.2         | -25.0          | -27.2         |       |
|                                 | 5190.00                                                                                                                                                                                                                          | -15.9               | H                  | 3.0             | 43.8           | 1.0            | -58.7         | -25.0          | -33.7         |       |
|                                 | 7785.00                                                                                                                                                                                                                          | -13.4               | H                  | 3.0             | 42.3           | 1.0            | -54.7         | -25.0          | -29.7         |       |
|                                 | 10380.00                                                                                                                                                                                                                         | -12.7               | H                  | 3.0             | 40.7           | 1.0            | -52.4         | -25.0          | -27.4         |       |
|                                 | PCC 2590.2MHz, SCC 2610.0MHz                                                                                                                                                                                                     |                     |                    |                 |                |                |               |                |               |       |
|                                 | 5200.00                                                                                                                                                                                                                          | -14.4               | V                  | 3.0             | 43.8           | 1.0            | -57.2         | -25.0          | -32.2         |       |
|                                 | 7800.00                                                                                                                                                                                                                          | -10.8               | V                  | 3.0             | 42.3           | 1.0            | -52.1         | -25.0          | -27.1         |       |
|                                 | 10400.00                                                                                                                                                                                                                         | -12.8               | V                  | 3.0             | 40.7           | 1.0            | -52.5         | -25.0          | -27.5         |       |
|                                 | 5200.00                                                                                                                                                                                                                          | -15.8               | H                  | 3.0             | 43.8           | 1.0            | -58.6         | -25.0          | -33.6         |       |
|                                 | 7800.00                                                                                                                                                                                                                          | -11.2               | H                  | 3.0             | 42.3           | 1.0            | -52.5         | -25.0          | -27.5         |       |
|                                 | 10400.00                                                                                                                                                                                                                         | -12.0               | H                  | 3.0             | 40.7           | 1.0            | -51.7         | -25.0          | -26.7         |       |