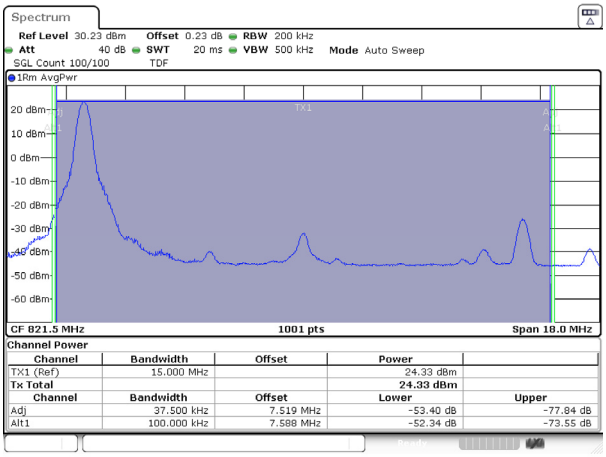
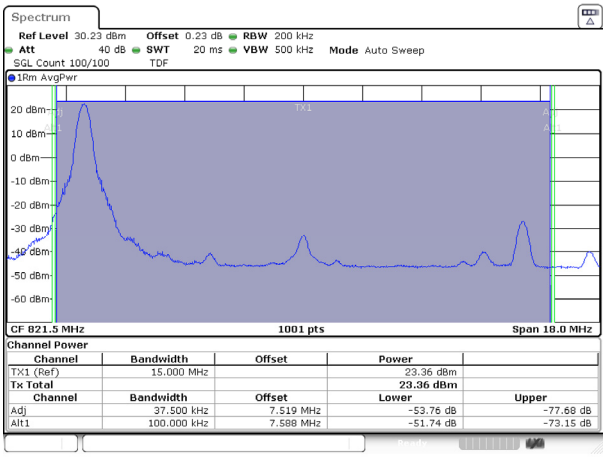
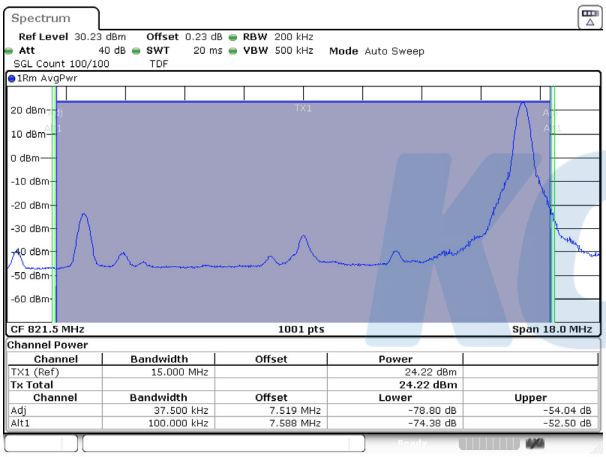
## 15M BW / QPSK / Mid ch. / Lower / 1RB



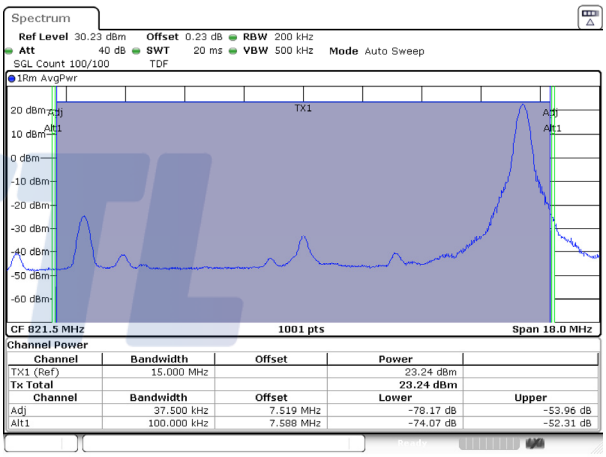

## 15M BW / 16QAM / Mid ch. / Lower / 1RB



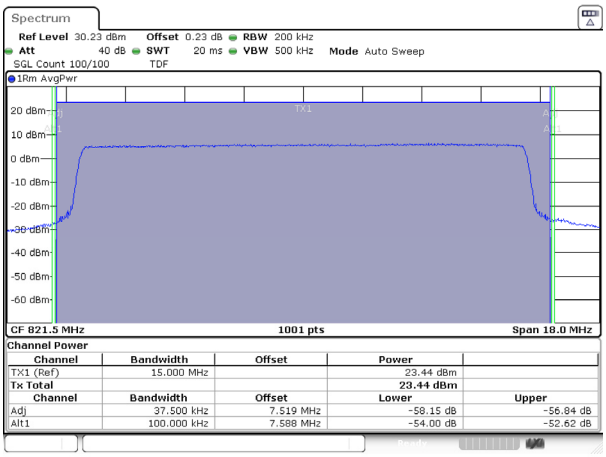

## 15M BW / QPSK / Mid ch. / Upper / 1RB



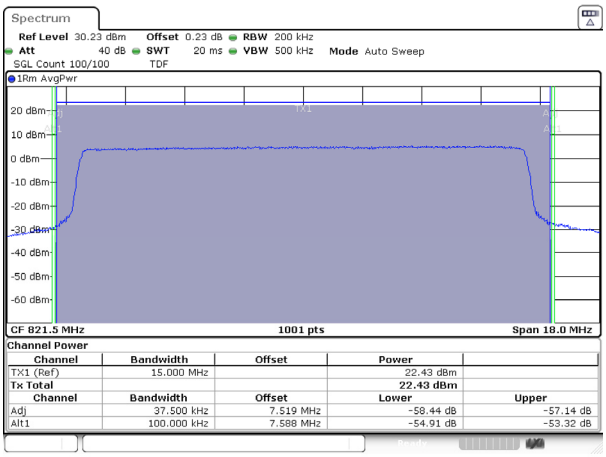

## 15M BW / 16QAM / Mid ch. / Upper / 1RB




## 15M BW / QPSK / Mid ch. / FRB

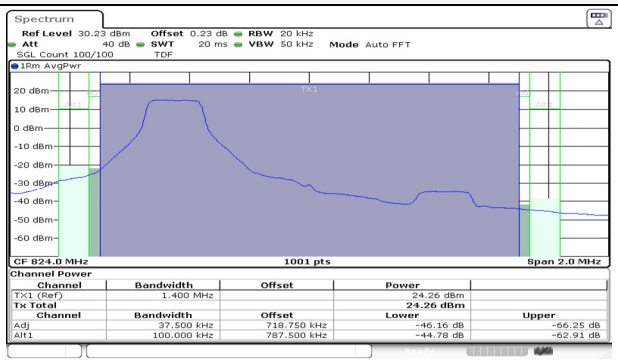



## 15M BW / 16QAM / Mid ch. / FRB

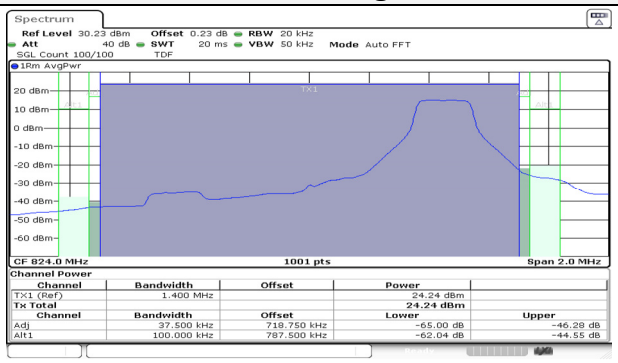


## Straddle channel

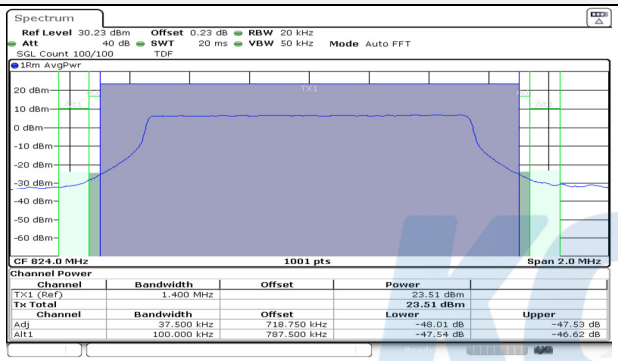
### 1.4M BW / QPSK / Low ch. / 1RB



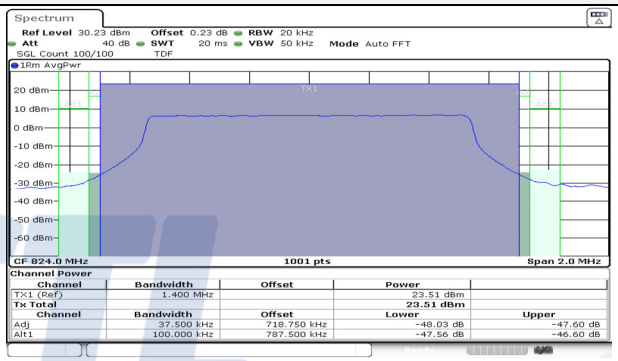

### 1.4M BW / QPSK / High ch. / 1RB



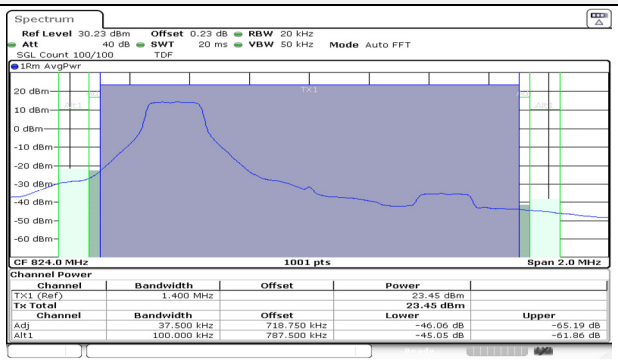

### 1.4M BW / QPSK / Low ch. / FRB



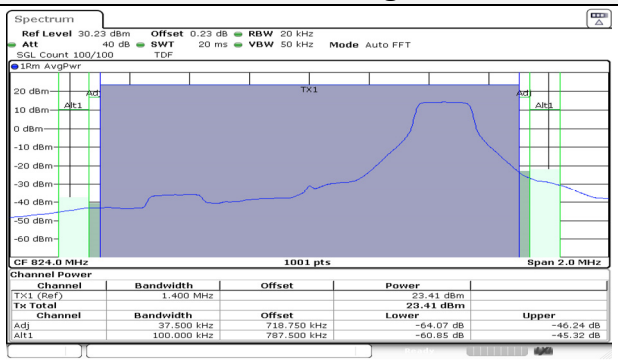

### 1.4M BW / QPSK / High ch. / FRB



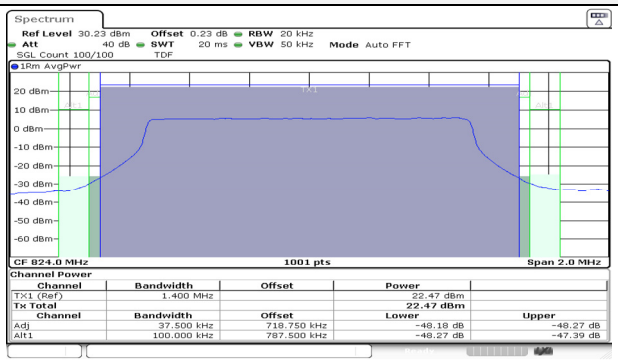

### 1.4M BW / 16QAM / Low ch. / 1RB



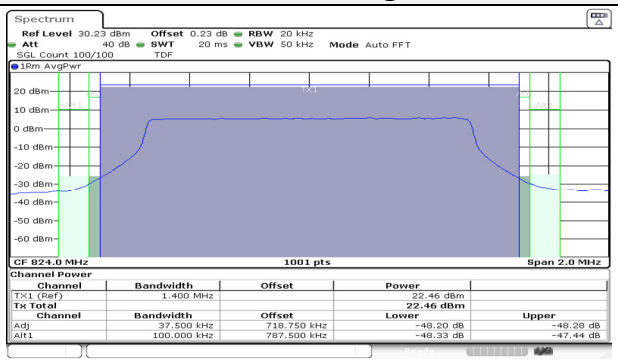

### 1.4M BW / 16QAM / High ch. / 1RB



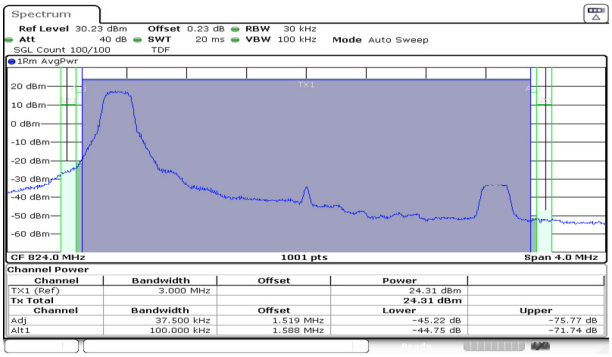

### 1.4M BW / 16QAM / Low ch. / FRB



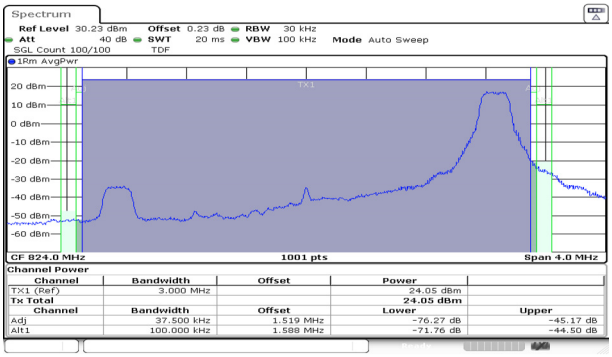

### 1.4M BW / 16QAM / High ch. / FRB



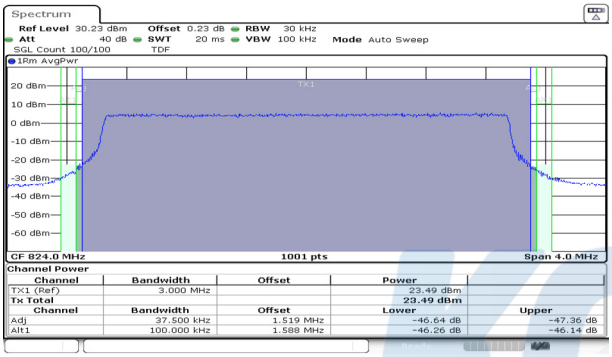
## 3M BW / QPSK / Low ch. / 1RB



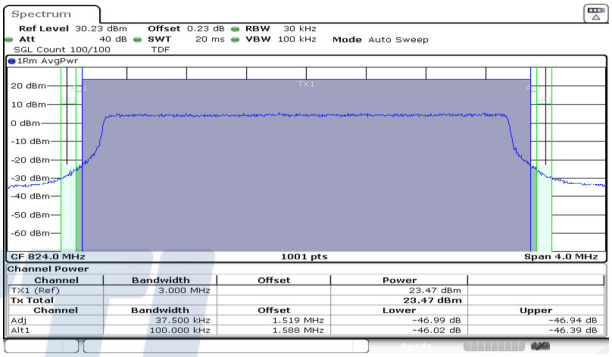

## 3M BW / QPSK / High ch. / 1RB



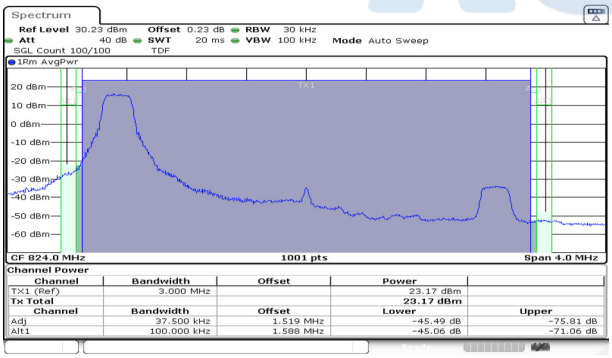

## 3M BW / QPSK / Low ch. / FRB



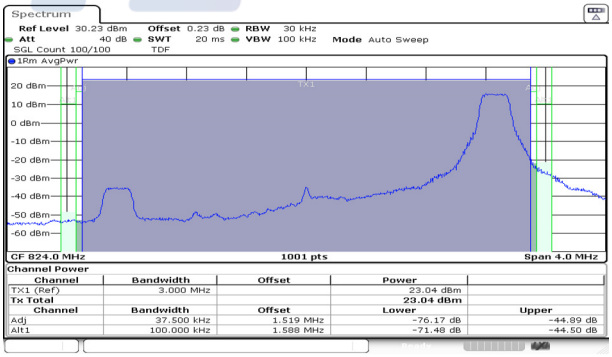

## 3M BW / QPSK / High ch. / FRB



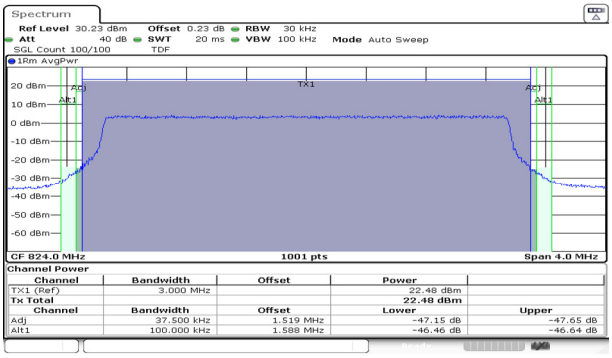

## 3M BW / 16QAM / Low ch. / 1RB



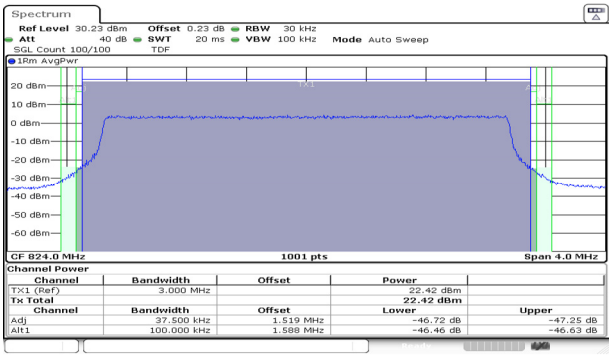

## 3M BW / 16QAM / High ch. / 1RB



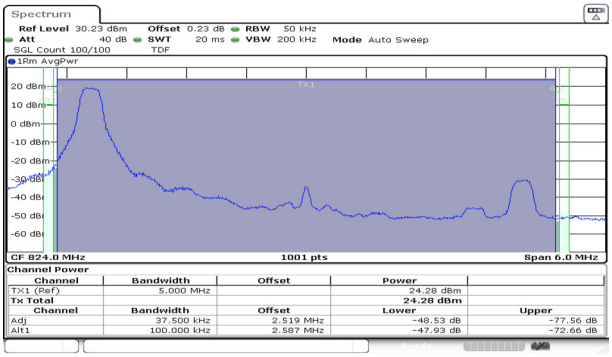

## 3M BW / 16QAM / Low ch. / FRB



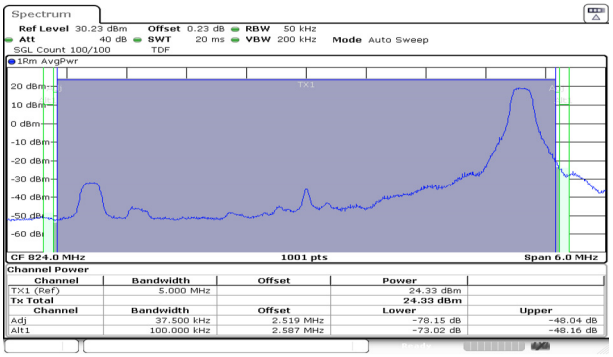

## 3M BW / 16QAM / High ch. / FRB



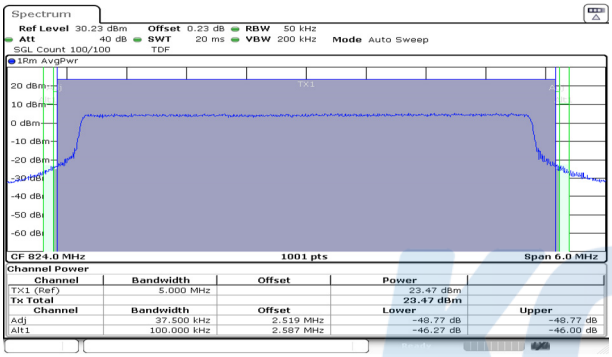
## 5M BW / QPSK / Low ch. / 1RB



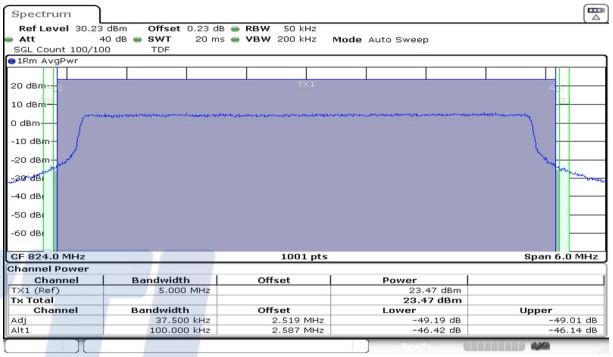

## 5M BW / QPSK / High ch. / 1RB



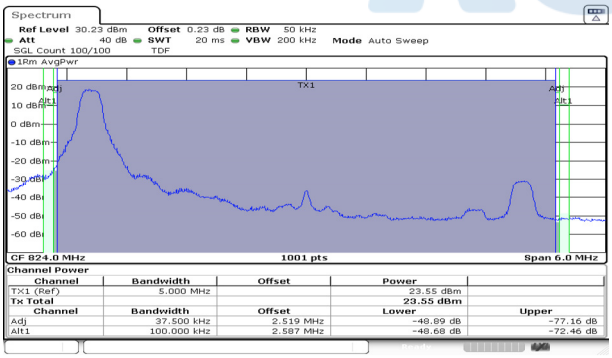

## 5M BW / QPSK / Low ch. / FRB



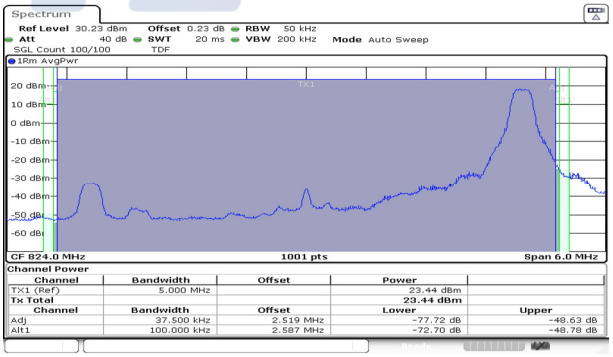

## 5M BW / QPSK / High ch. / FRB



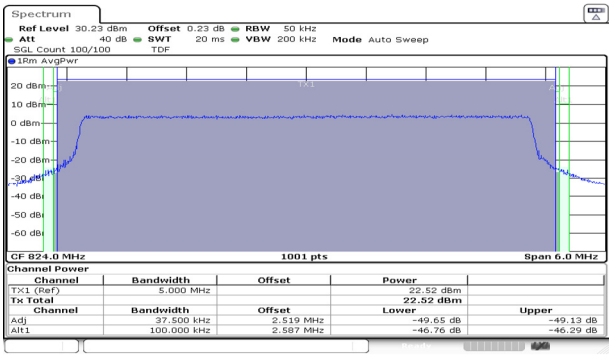

## 5M BW / 16QAM / Low ch. / 1RB



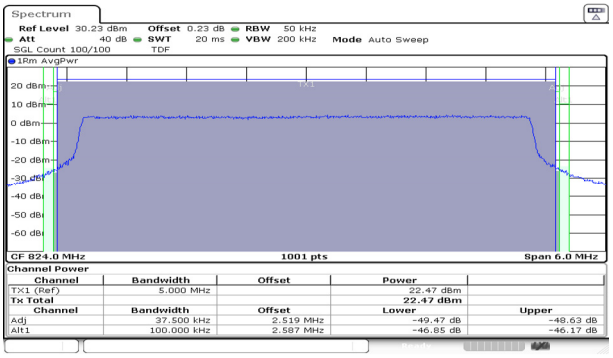

## 5M BW / 16QAM / High ch. / 1RB




## 5M BW / 16QAM / Low ch. / FRB

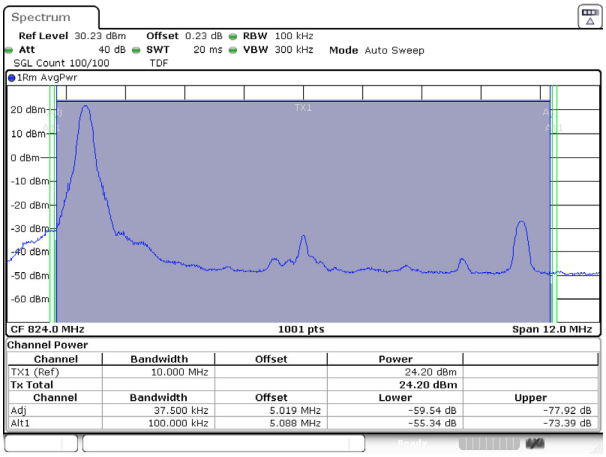



## 5M BW / 16QAM / High ch. / FRB

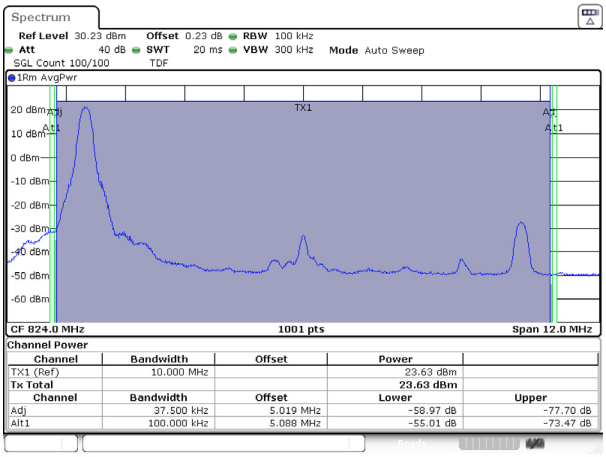



This test report shall not be reproduced, except in full, without the written approval

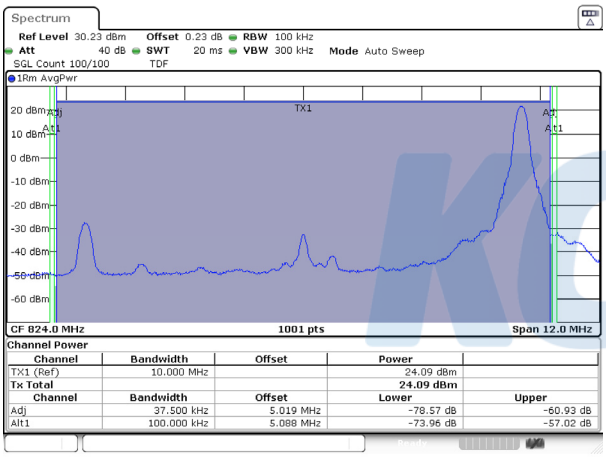
## 10M BW / QPSK / Mid ch. / Lower / 1RB



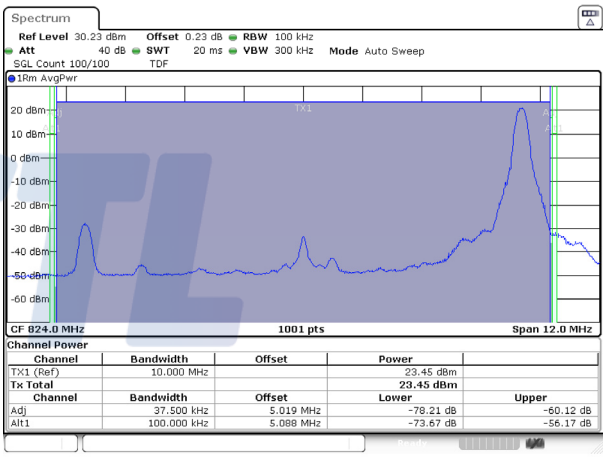

## 10M BW / 16QAM / Mid ch. / Lower / 1RB



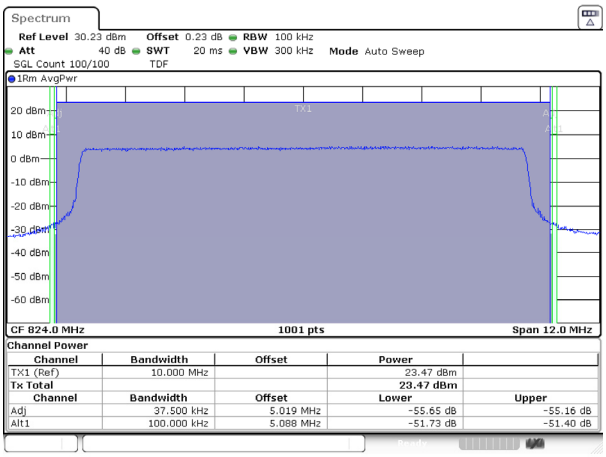

## 10M BW / QPSK / Mid ch. / Upper / 1RB



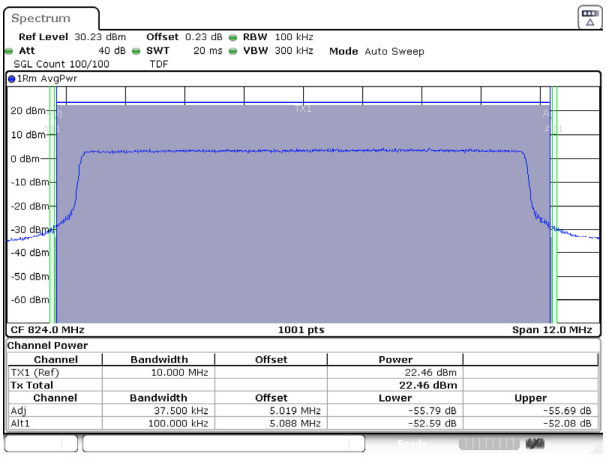

## 10M BW / 16QAM / Mid ch. / Upper / 1RB



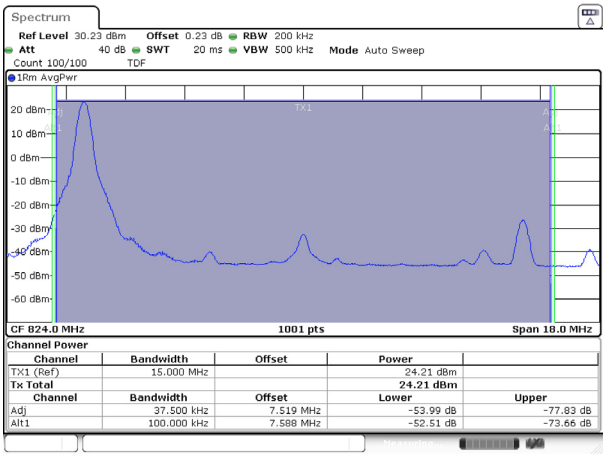

## 10M BW / QPSK / Mid ch. / FRB



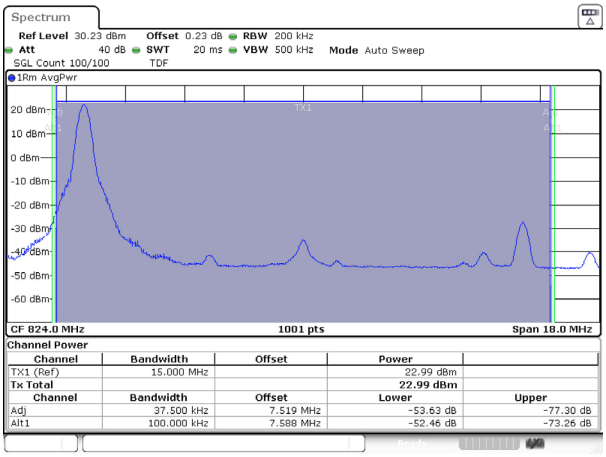

## 10M BW / 16QAM / Mid ch. / FRB



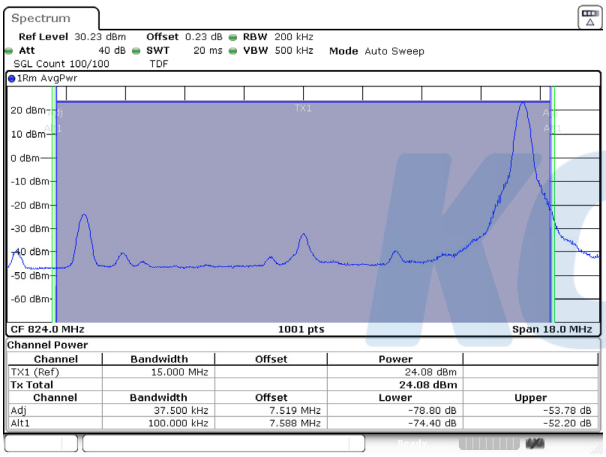
## 15M BW / QPSK / Mid ch. / Lower / 1RB



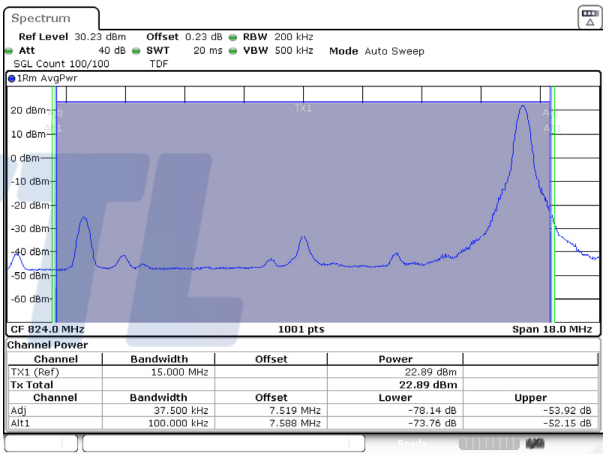

## 15M BW / 16QAM / Mid ch. / Lower / 1RB



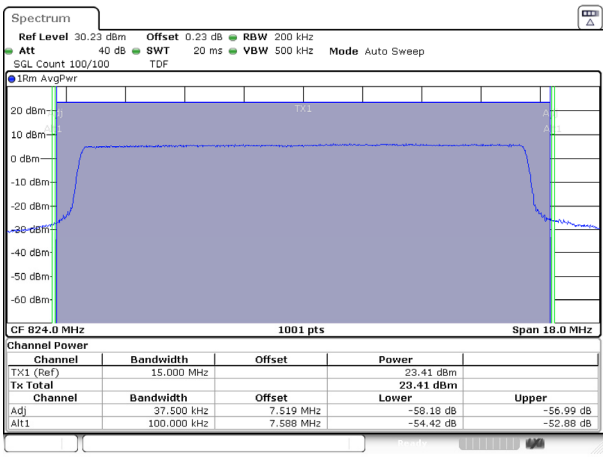

## 15M BW / QPSK / Mid ch. / Upper / 1RB



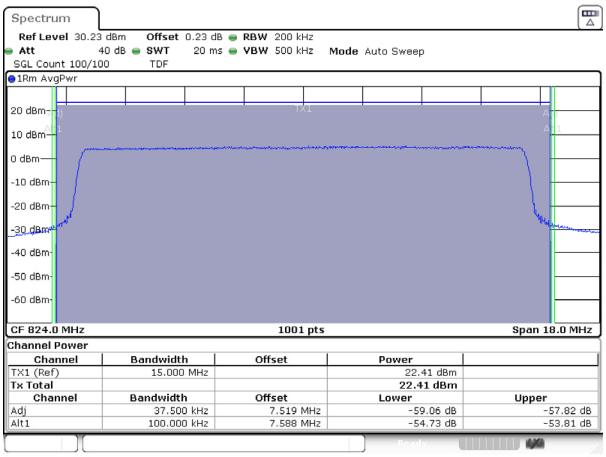

## 15M BW / 16QAM / Mid ch. / Upper / 1RB




## 15M BW / QPSK / Mid ch. / FRB

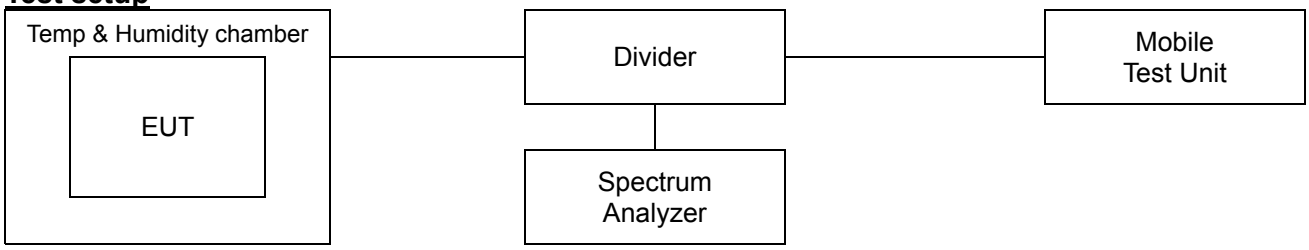



## 15M BW / 16QAM / Mid ch. / FRB



## 7.5. Frequency stability

**Test setup**




**Limit**

**According to §2.1055(a),**

The frequency stability shall be measured with variation of ambient temperature as follows:

1) From -30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
2) From -20° to + 50° centigrade for equipment to be licensed for use in the maritime services under part 80 of this chapter, except for class A, B, and S emergency position indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 ㎒ at operational fixed stations in all services, stations in the local television transmission service and point-to-point microwave radio service under part 21 of this chapter, equipment licensed for use aboard aircraft in the aviation services under part 87 of this chapter, and equipment authorized for use in the family radio service under part 95 of this chapter.
3) From 0° to + 50° centigrade for equipment to be licensed for use in the radio broadcast Services under part 73 of this chapter.

**According to §2.1055(d),**

The frequency stability shall be measured with variation of primary supply Voltage as follows:

1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating and point which shall be specified by the manufacturer.
3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

**According to §90.213**

For mobile devices operating in the 809 to 824 ㎒ band at a power level 2 Watts or less, the limit specified in Table is ±2.5 ppm.

**Test procedure**

ANSI 63.26-2015 – Section 5.6

**Test settings**

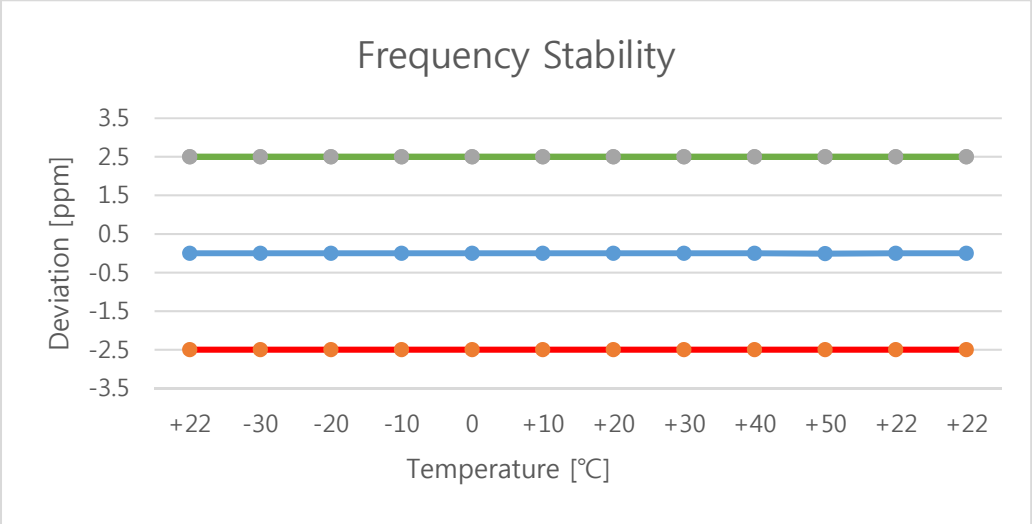
1) The carrier frequency of the transmitter is measured at room temperature. (20°C to provide a reference)
2) The equipment is turned on in a “standby” condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3) Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each Temperature level.

KCTL

## Test results

Test mode : LTE Band 26 (Part 90)
Frequency (Hz) : 819 000 000
Channel : 26740
Deviation limit : ±0.00025% or 2.5ppm

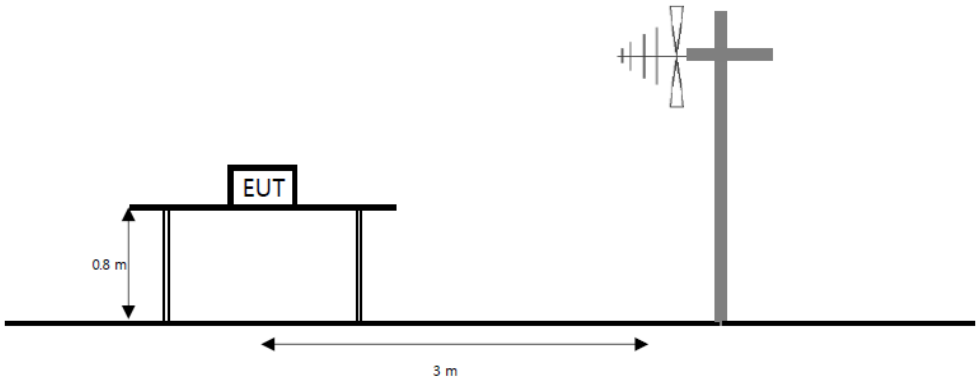
| Voltage (%) | Power (V) | Temp. (°C) | Frequency (Hz) | Frequency error (Hz) | Deviation | |
|---|---|---|---|---|---|---|
| | | | | | (ppm) | (%) |
| 100% | 3.85 | +22(Ref) | 818,999,997 | -2.69 | 0.0 | 0.000000 |
| | | -30 | 818,999,998 | -2.11 | 0.0 | 0.000000 |
| | | -20 | 819,000,002 | 2.28 | 0.0 | 0.000000 |
| | | -10 | 819,000,001 | 0.55 | 0.0 | 0.000000 |
| | | 0 | 818,999,999 | -1.40 | 0.0 | 0.000000 |
| | | +10 | 818,999,998 | -1.98 | 0.0 | 0.000000 |
| | | +20 | 818,999,997 | -2.69 | 0.0 | 0.000000 |
| | | +30 | 818,999,997 | -3.48 | 0.0 | 0.000000 |
| | | +40 | 818,999,996 | -3.62 | 0.0 | 0.000000 |
| | | +50 | 818,999,995 | -4.73 | 0.0 | -0.000001 |
| 115% | 4.43 | +22 | 818,999,997 | -2.63 | 0.0 | 0.000000 |
| End point | 2.55 | +22 | 818,999,997 | -2.73 | 0.0 | 0.000000 |



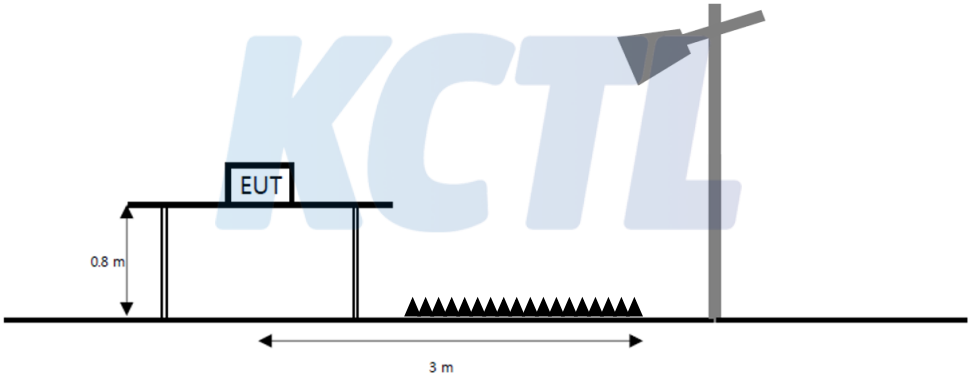
## 7.6. Radiated Power (ERP/EIRP)

**Test setup**

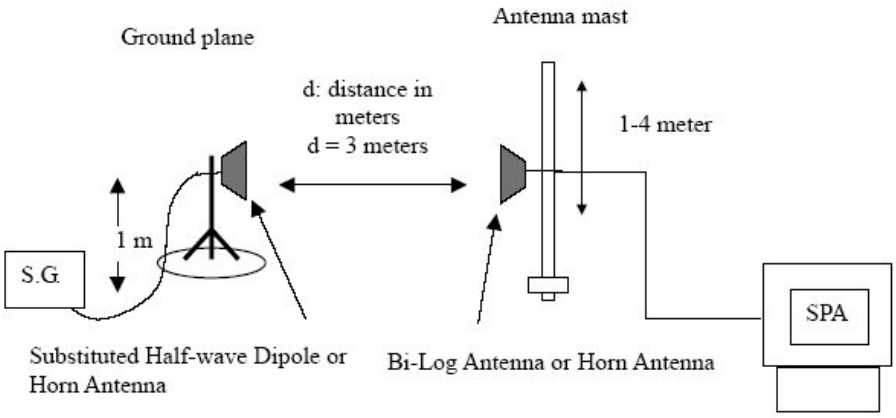
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.




The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.




The diagram below shows the test setup for substituted method.



**Limit**

According to §90.635(b), the maximum output power of the transmitter for mobile stations is 100 watts(20 dBw).

**Test procedure**

971168 D01 v03r01 - Section 5.2 and 5.8
ANSI 63.26-2015 – Section 5.2
ANSI/TIA-603-E-2016 - Section 2.2.17

**Test settings**

1) RBW = 1 % to 5 % of the OBW.
2) VBW ≥ 3 × RBW.
3) SPAN = 2 × to 3 × the OBW.
4) Number of measurement points in sweep ≥ 2 × span / RBW.
5) Sweep time :
   1) Auto couple, or
   2) ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. Transmission period is the on and off time of the transmitter.
6) Detector = RMS
7) If the EUT can be configured to transmit continuously, then set the trigger to free run.
8) If the EUT cannot be configured to transmit continuously, then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Verify that the sweep time is less than or equal to the transmission burst duration. Time gating can also be used under similar constraints (i.e., configured such that measurement data is collected only during active full -power transmissions).
9) Trace mode = trace averaging (RMS) over 100 sweeps.
10) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
11) Allow trace to fully stabilize.

**Notes:**

1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close To normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to Correspond to the fundamental frequency of the transmitter.
3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the Level of the maximized emission.
4. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
5. The maximum signal level detected by the measuring receiver shall be noted.
6. The EUT was replaced by half-wave dipole (1 ㎓ below) or horn antenna (1 ㎓ above) connected to a signal generator.
   The power is calculated by the following formula;
   Pd(㏈m) = Pg(㏈m) – Cable loss (㏈) + Antenna gain (㏈)
   Note. Pd is the dipole equivalent power and Pg is the generator output power into the substitution antenna.
7. The test antenna shall be raised and lowered through the specified range of height to ensure that The maximum signal is received.
8. The input signal to the substitution antenna shall be adjusted to the level that produces a level Detected by the measuring corrected for the change of input attenuator setting of the measuring Receiver.
9. The input level to the substitution antenna shall be recorded as power level in ㏈m, corrected for Any change of input attenuator setting of the measuring receiver.
10. The measurement shall be repeated with the test antenna and the substitution antenna Orientated for horizontal polarization.

## Test results

### Test mode: LTE Band 26 (Part 90)

| Bandwidth | Modulation | Frequency | Pol. | Antenna Gain | C.L | Substitute Level | ERP | |
|---|---|---|---|---|---|---|---|---|
| | | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [W] |
| 1.4 M | QPSK | 814.7 | H | -0.40 | 4.97 | 25.24 | 19.87 | 0.097 |
| | | 823.3 | H | -0.60 | 5.05 | 25.52 | 19.87 | 0.097 |
| | 16QAM | 814.7 | H | -0.40 | 4.97 | 24.03 | 18.66 | 0.073 |
| | | 823.3 | H | -0.60 | 5.05 | 24.52 | 18.87 | 0.077 |
| 3 M | QPSK | 815.5 | H | -0.40 | 4.99 | 25.25 | 19.86 | 0.097 |
| | | 822.5 | H | -0.60 | 5.03 | 25.75 | **20.12** | **0.103** |
| | 16QAM | 815.5 | H | -0.40 | 4.99 | 24.07 | 18.68 | 0.074 |
| | | 822.5 | H | -0.60 | 5.03 | 24.58 | 18.95 | 0.079 |
| 5 M | QPSK | 816.5 | H | -0.40 | 4.97 | 25.30 | 19.93 | 0.098 |
| | | 821.5 | H | -0.60 | 5.04 | 25.58 | 19.94 | 0.099 |
| | 16QAM | 816.5 | H | -0.40 | 4.97 | 24.27 | 18.90 | 0.078 |
| | | 821.5 | H | -0.60 | 5.04 | 24.61 | 18.97 | 0.079 |
| 10 M | QPSK | 819.0 | H | -0.40 | 5.01 | 25.48 | 20.07 | 0.102 |
| | 16QAM | 819.0 | H | -0.40 | 5.01 | 24.28 | 18.87 | 0.077 |
| 15 M | QPSK | 821.5 | H | -0.60 | 5.04 | 25.63 | 19.99 | 0.100 |
| | 16QAM | 821.5 | H | -0.60 | 5.04 | 24.67 | 19.03 | 0.080 |

### Straddle channel

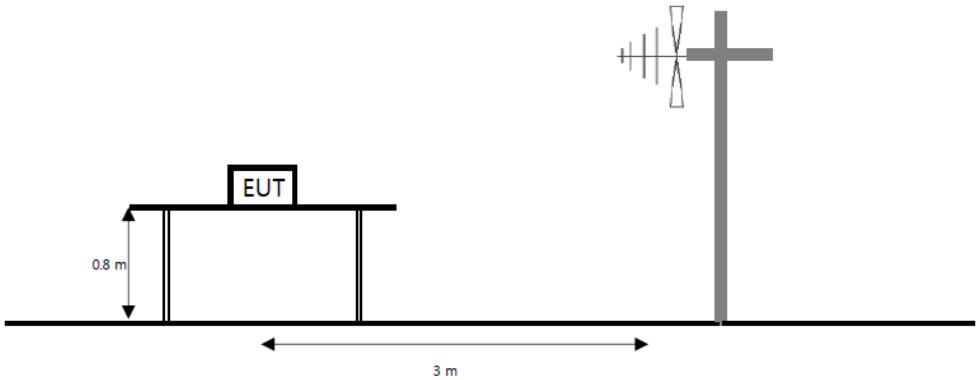
| Bandwidth | Modulation | Frequency | Pol. | Antenna Gain | C.L | Substitute Level | ERP | |
|---|---|---|---|---|---|---|---|---|
| | | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [W] |
| 1.4 M | QPSK | 824 | H | -0.40 | 5.06 | 25.42 | 19.96 | 0.099 |
| | 16QAM | | H | -0.60 | 5.06 | 24.39 | 18.73 | 0.075 |
| 3 M | QPSK | | H | -0.40 | 5.06 | 25.45 | **19.99** | **0.100** |
| | 16QAM | | H | -0.60 | 5.06 | 24.28 | 18.62 | 0.073 |
| 5 M | QPSK | | H | -0.40 | 5.06 | 25.42 | 19.96 | 0.099 |
| | 16QAM | | H | -0.60 | 5.06 | 24.70 | 19.04 | 0.080 |
| 10 M | QPSK | | H | -0.40 | 5.06 | 25.44 | 19.98 | 0.100 |
| | 16QAM | | H | -0.60 | 5.06 | 24.53 | 18.87 | 0.077 |
| 15 M | QPSK | | H | -0.40 | 5.06 | 25.38 | 19.92 | 0.098 |
| | 16QAM | | H | -0.40 | 5.06 | 24.31 | 18.85 | 0.077 |

Note.
1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

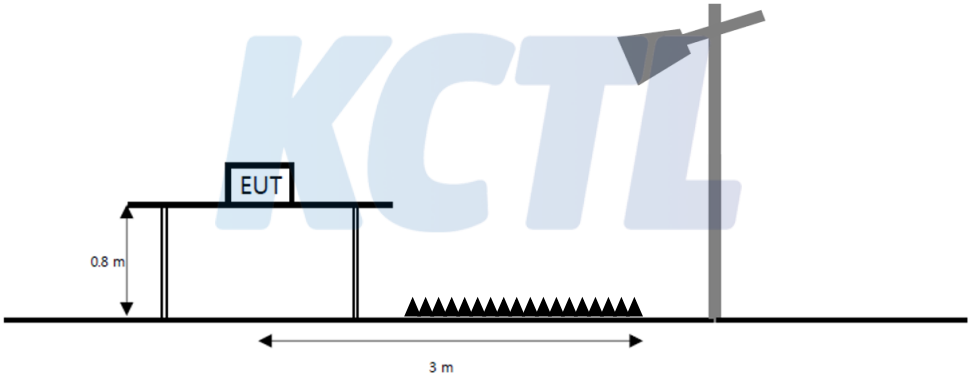
## 7.7. Radiated Spurious Emissions

**Test setup**

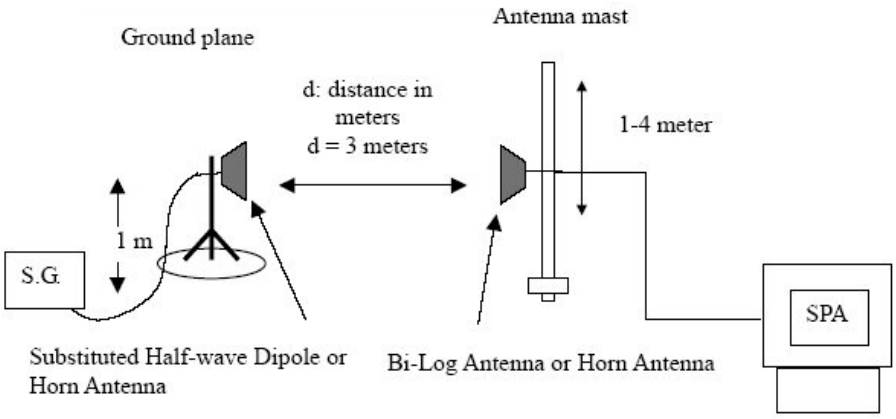
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.




The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.




The diagram below shows the test setup for substituted method.



**Limit**

According to §90.691(a), Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 $Log_{10}(f/6.1)$ decibels or 50 + $10Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz where f is greater than 12.5 ㎑.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + $10Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 ㎑.

**Test procedure**

971168 D01 v03r01 - Section 6.2
ANSI 63.26-2015 – Section 5.5
ANSI/TIA-603-E-2016 - Section 2.2.12

**Test settings**

1) RBW = 1 ㎑ for below 1 ㎓ and 1 ㎒ for above 1 ㎓.
2) VBW ≥ 3 × RBW.
3) Detector = RMS
4) Trace mode = Max hold
5) Sweep time = Auto couple
6) Number of sweep points ≥ 2 × span / RBW
7) Allow trace to fully stabilize.

**Notes:**

1. On a test site, the EUT shall be placed at 80 ㎝ height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the level of the maximized emission.
4. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
5. The maximum signal level detected by the measuring receiver shall be noted.
6. The EUT was replaced by half-wave dipole (1 ㎓ below) or horn antenna (1 ㎓ above) connected to a signal generator.
7. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
8. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring corrected for the change of input attenuator setting of the measuring receiver.
9. The input level to the substitution antenna shall be recorded as power level in ㏈m, corrected for any change of input attenuator setting of the measuring receiver.
10. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

This test report shall not be reproduced, except in full, without the written approval

**Test results (Above 1 000 ㎒)**

Test mode : LTE Band 26 (Part 90)
Frequency(㎒) : 815.5
Channel : 26705
Bandwidth(㎒) : 3

| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 1 631.54 | H | 6.44 | 5.33 | -65.81 | -64.70 | -13.00 | 51.70 |
| | 2 447.09 | H | 6.00 | 6.59 | -54.91 | -55.50 | -13.00 | 42.50 |
| | 3 262.64 | H | 7.28 | 7.62 | -57.36 | -57.70 | -13.00 | 44.70 |
| | 4 080.69 | V | 8.68 | 8.52 | -56.76 | -56.60 | -13.00 | 43.60 |

Test mode : LTE Band 26 (Part 90)
Frequency(㎒) : 822.5
Channel : 26775
Bandwidth(㎒) : 3

| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 1 645.54 | H | 6.43 | 5.36 | -60.17 | -59.10 | -13.00 | 46.10 |
| | 2 468.09 | H | 6.00 | 6.62 | -52.98 | -53.60 | -13.00 | 40.60 |
| | 3 290.14 | H | 7.34 | 7.65 | -58.59 | -58.90 | -13.00 | 45.90 |
| | 4 113.19 | V | 8.71 | 8.58 | -57.63 | -57.50 | -13.00 | 44.50 |

Test mode : LTE Band 26 (Straddle channel)
Frequency(㎒) : 824.0
Channel : 26790
Bandwidth(㎒) : 3

| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 1 648.54 | H | 6.42 | 5.36 | -59.66 | -58.60 | -13.00 | 45.60 |
| | 2 472.59 | H | 6.00 | 6.63 | -53.77 | -54.40 | -13.00 | 41.40 |
| | 3 296.64 | H | 7.35 | 7.66 | -57.49 | -57.80 | -13.00 | 44.80 |
| | 4 121.20 | V | 8.72 | 8.59 | -58.23 | -58.10 | -13.00 | 45.10 |

Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

## 8. Measurement equipment

| Equipment Name | Manufacturer | Model No. | Serial No. | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSV30 | 100808 | 20.07.30 |
| Spectrum Analyzer | R&S | FSV30 | 100806 | 20.07.30 |
| Spectrum Analyzer | AGILENT | N9040B | MY57010132 | 20.07.31 |
| Vector Signal Generator | R&S | SMBV100A | 257566 | 20.07.16 |
| Signal Generator | R&S | SMR40 | 100007 | 20.05.13 |
| Signal Generator | R&S | SMB100A | 176206 | 21.01.21* |
| Wideband Radio Communication Tester | R&S | CMW500 | 141780 | 20.04.18 |
| Wideband Radio Communication Tester | R&S | CMW500 | 137524 | 20.07.17 |
| DC Power Supply | AGILENT | E3632A | MY40001543 | 20.05.13 |
| DC Power Supply | AGILENT | E3632A | MY40018781 | 20.05.13 |
| Power Divider | AGILENT | 11636B | 54456 | 21.01.06 |
| Power Divider | Aeroflex/Weinschel, Inc. | 1580-1 | RZ184 | 21.01.06 |
| Temp & Humid Chamber | ESPEC CORP. | SH-661 | 92004048 | 21.01.03 |
| Biconical VHF-UHF Broadband Antenna | SCHWARZBECK | VUBA9117 | 275 | 20.04.13 |
| Bilog Antenna | Teseq GmbH | CBL 6143A | 35039 | 21.05.21 |
| Horn Antenna | ETS.lindgren | 3115 | 62589 | 20.05.09 |
| Horn Antenna | ETS.lindgren | 3117 | 161225 | 20.05.22 |
| Horn Antenna | ETS.lindgren | 3116 | 00086632 | 20.02.15 |
| Horn Antenna | ETS.lindgren | 3116 | 00086635 | 20.05.09 |
| High pass Filter | Wainwright Instruments GmbH | WHKX3.0/18G-12SS | 44 | 21.01.21* |
| High pass Filter | Wainwright Instruments GmbH | WHKX1.0/1.5S-10SS | 14 | 21.01.21* |
| Attenuator | Weinschel ENGINEERING | 10 | AJ1239 | 20.05.14 |
| Attenuator | API Inmet | 40AH2W-10 | 12 | 20.05.15 |
| Amplifier | SONOMA INSTRUMENT | 310N | 186280 | 20.04.04 |
| Amplifier | L-3 Narda-MITEQ | AMF-7D-01001800-22-10P | 2031196 | 20.02.21 |
| Amplifier | L-3 Narda-MITEQ | JS44-18004000-33-8P | 2000997 | 20.08.01 |
| Antenna Mast | MATURO | EAS 1.5 | 042/8941211 | N/A |
| Antenna Mast | MATURO | EAS 1.5 | 043/8941211 | N/A |
| Turn Table | MATURO | TT 0.8 PF | 041/8941211 | N/A |

*The equipment was used after finished calibration.

**End of test report**

This test report shall not be reproduced, except in full, without the written approval