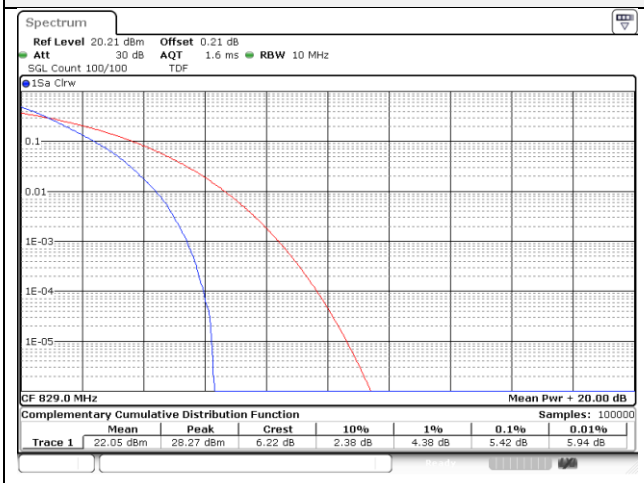
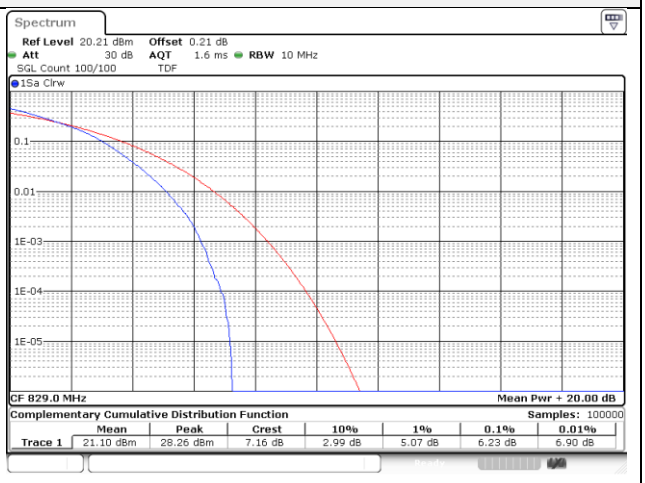
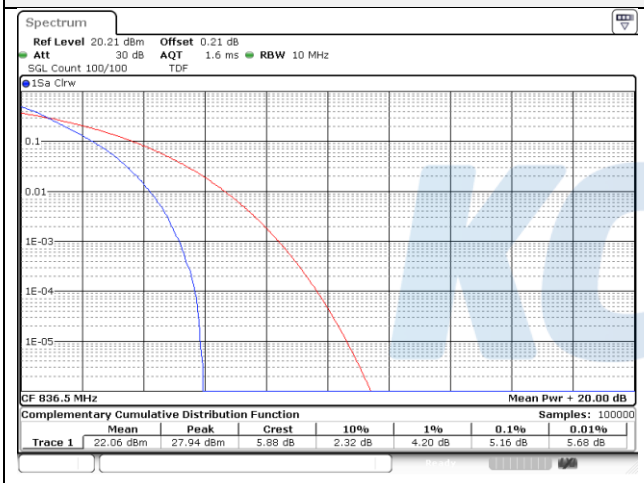
## 10M BW / QPSK / Low ch.



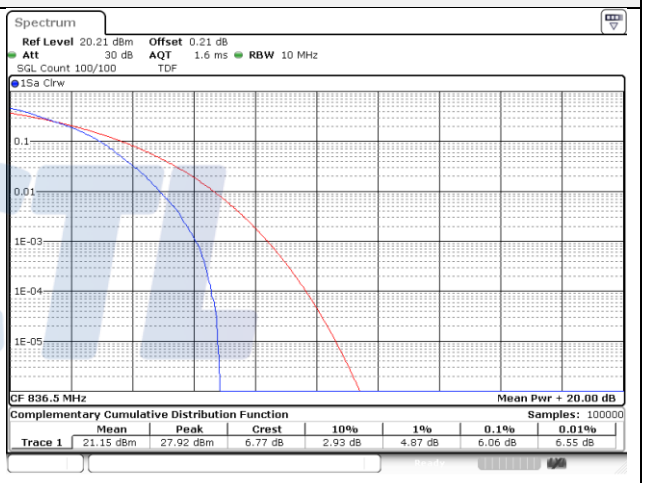

## 10M BW / 16QAM / Low ch.



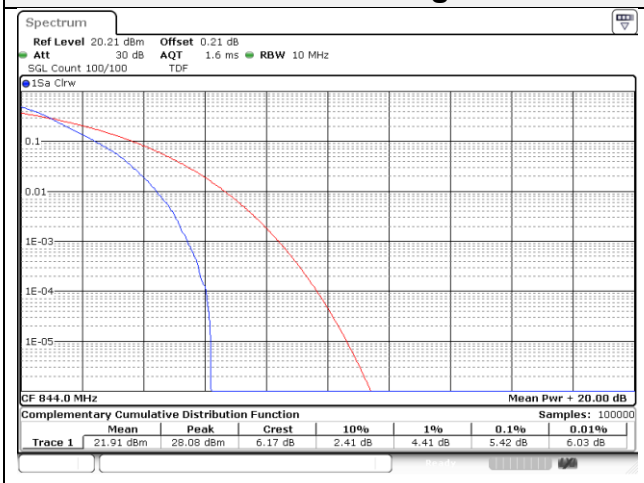

## 10M BW / QPSK / Mid ch.



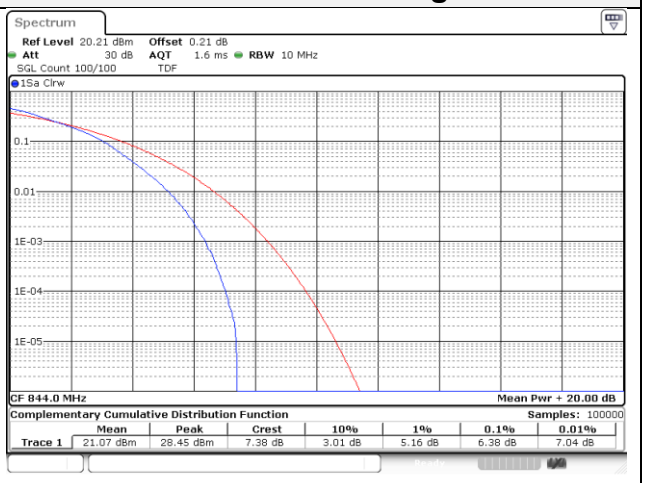

## 10M BW / 16QAM / Mid ch.




## 10M BW / QPSK / High ch.

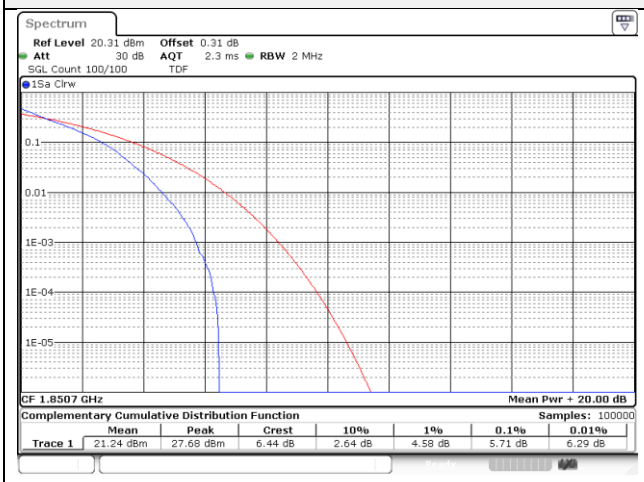



## 10M BW / 16QAM / High ch.

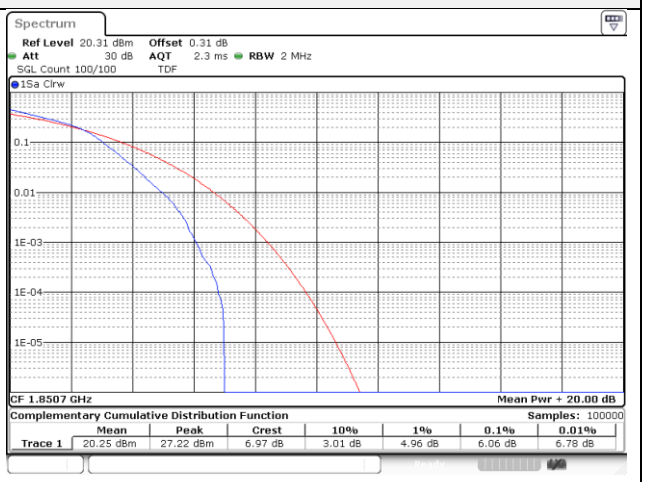


## Test mode: LTE Band2

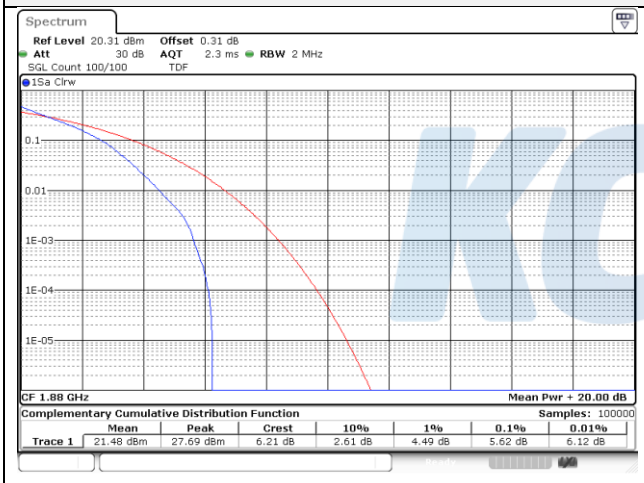
### 1.4M BW / QPSK / Low ch.



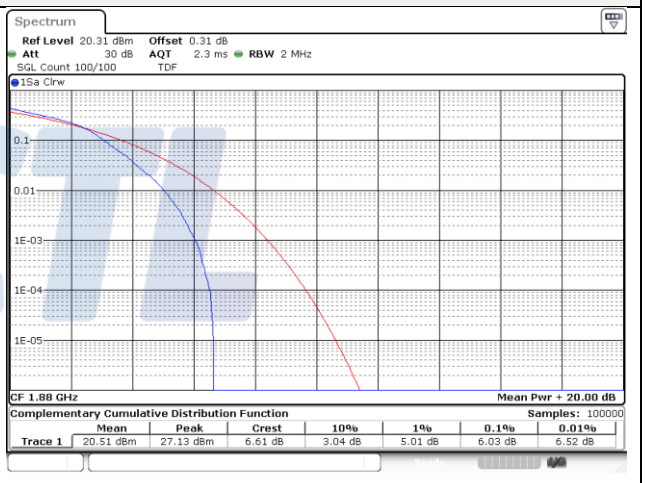

### 1.4M BW / 16QAM / Low ch.



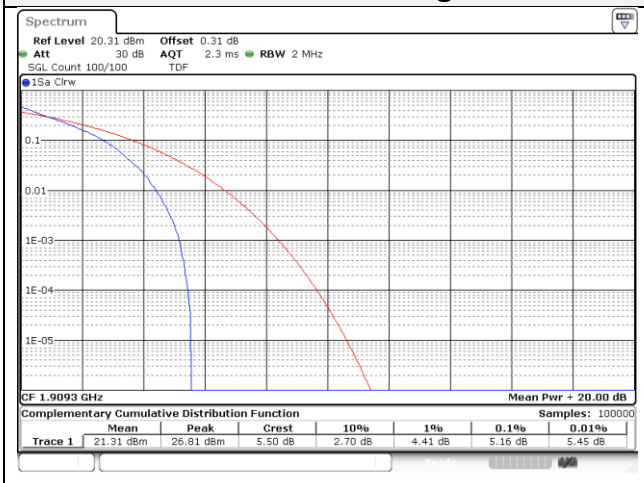

### 1.4M BW / QPSK / Mid ch.



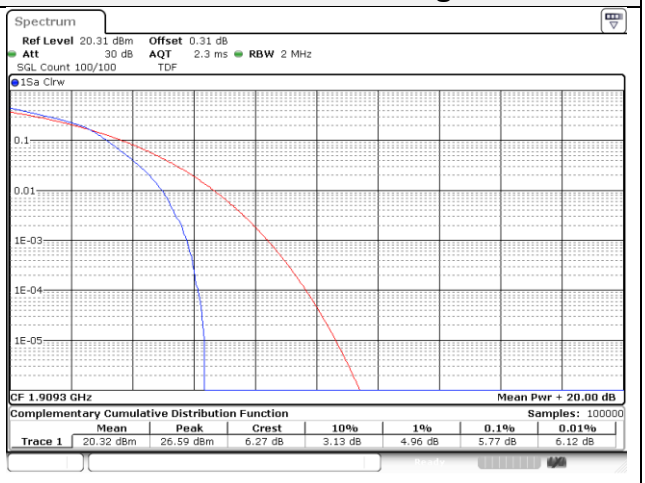

### 1.4M BW / 16QAM / Mid ch.



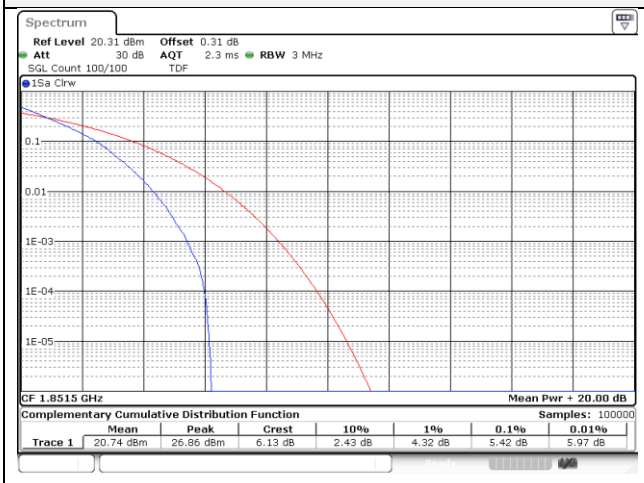

### 1.4M BW / QPSK / High ch.



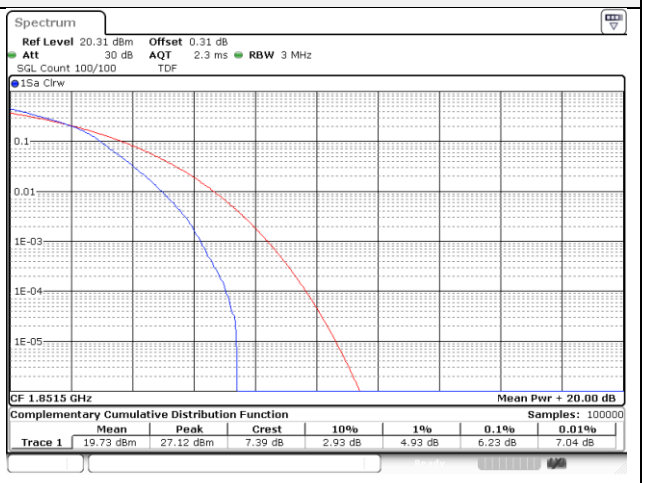

### 1.4M BW / 16QAM / High ch.



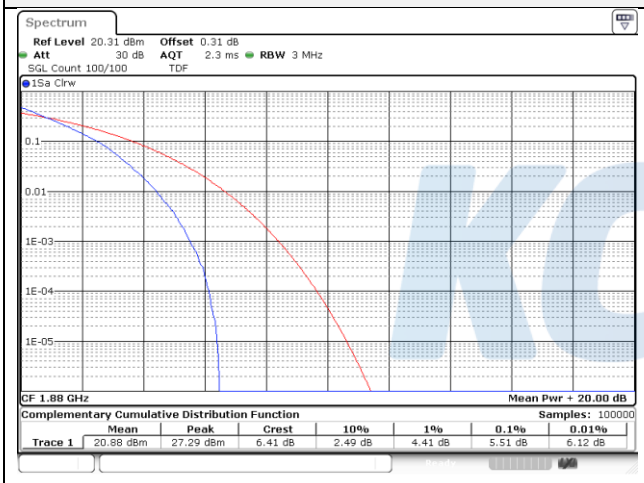
### 3M BW / QPSK / Low ch.



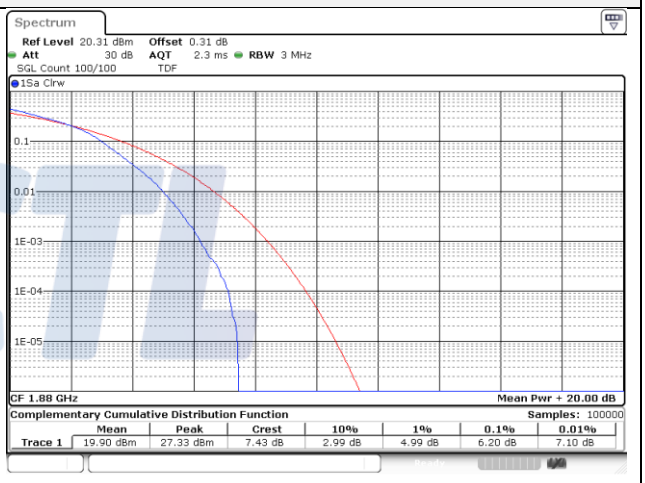

### 3M BW / 16QAM / Low ch.



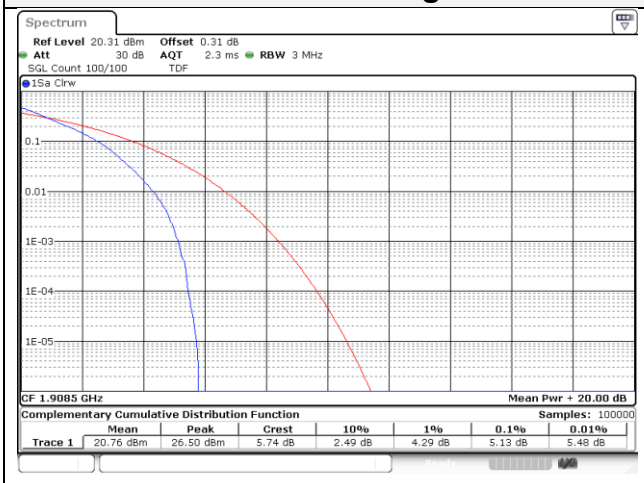

### 3M BW / QPSK / Mid ch.



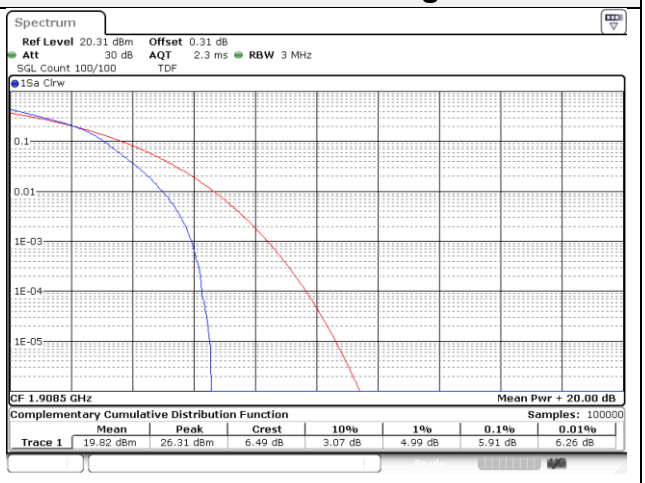

### 3M BW / 16QAM / Mid ch.



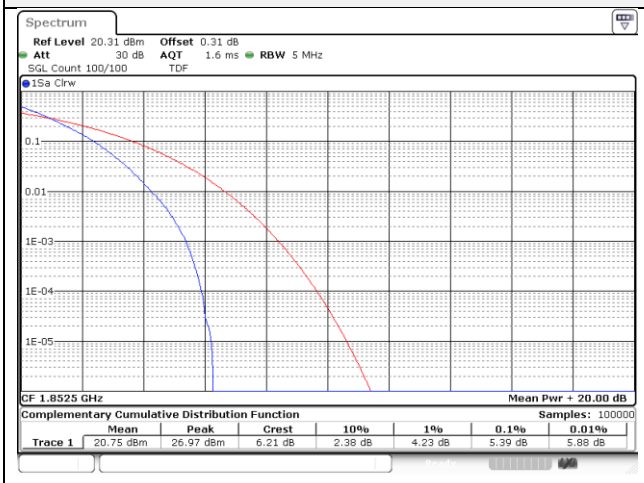

### 3M BW / QPSK / High ch.



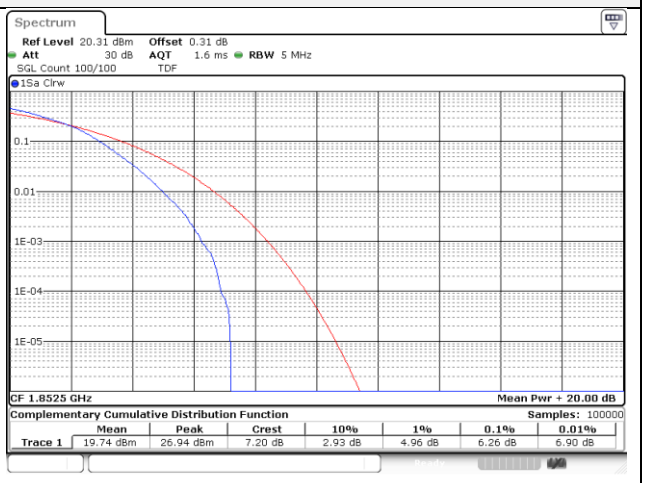

### 3M BW / 16QAM / High ch.



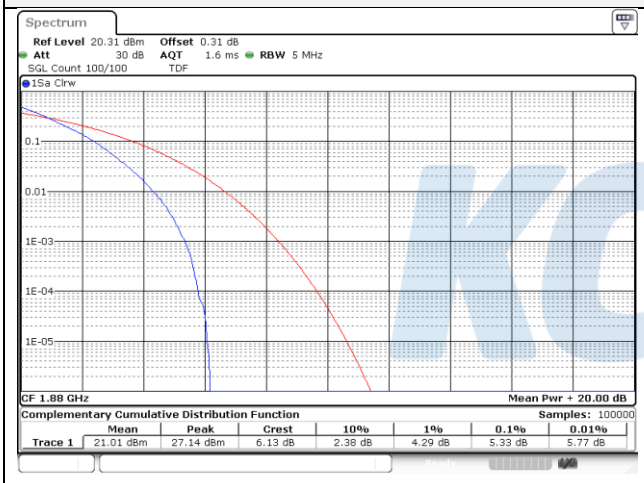
## 5M BW / QPSK / Low ch.



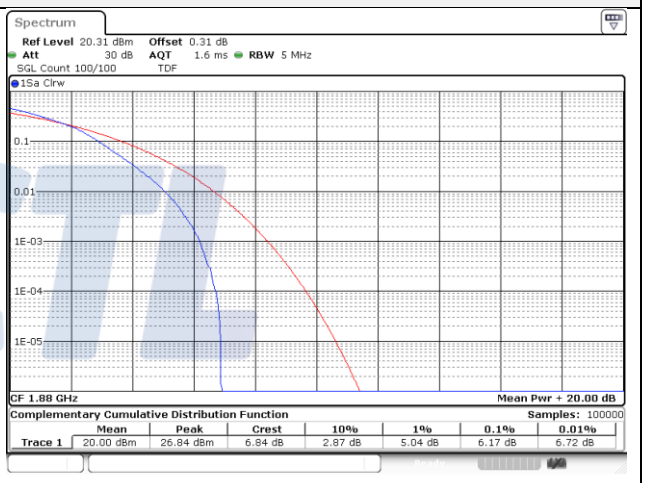

## 5M BW / 16QAM / Low ch.



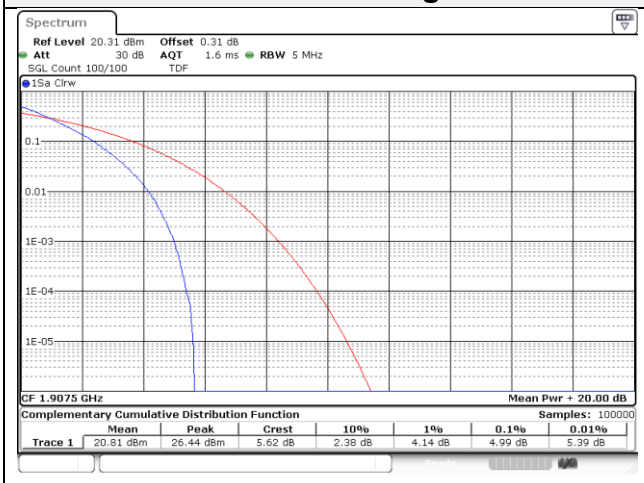

## 5M BW / QPSK / Mid ch.



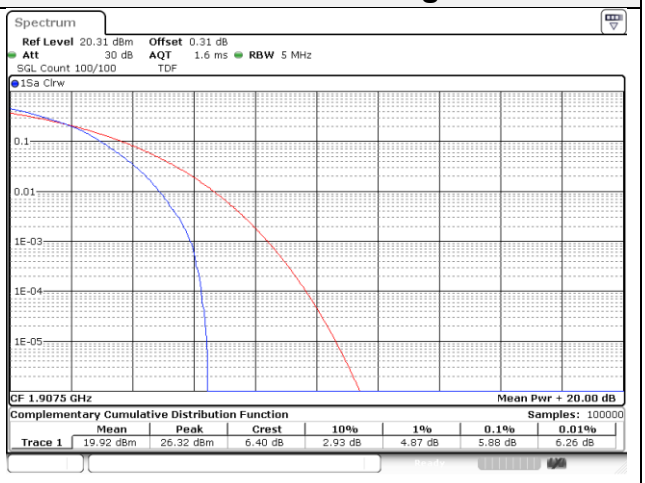

## 5M BW / 16QAM / Mid ch.



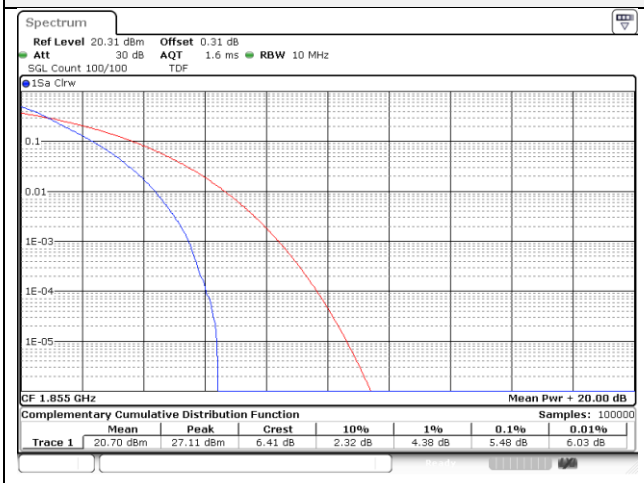

## 5M BW / QPSK / High ch.



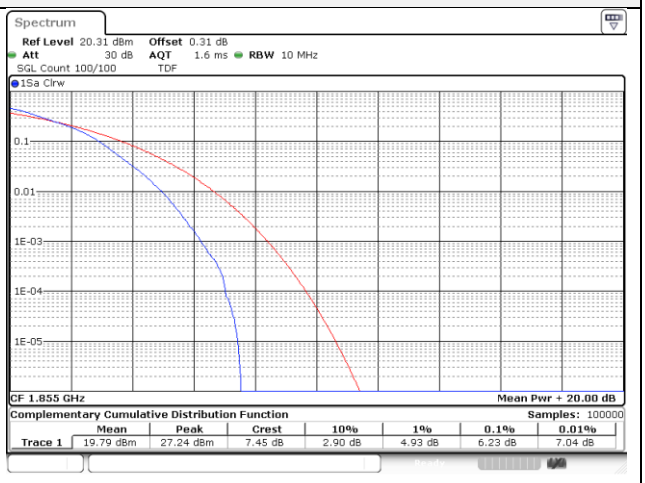

## 5M BW / 16QAM / High ch.



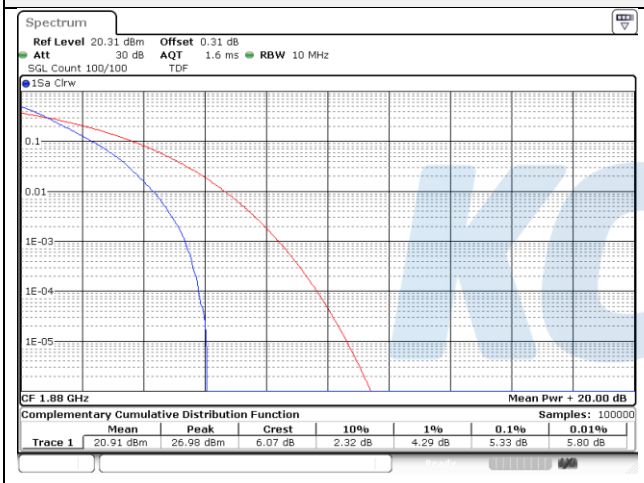
### 10M BW / QPSK / Low ch.



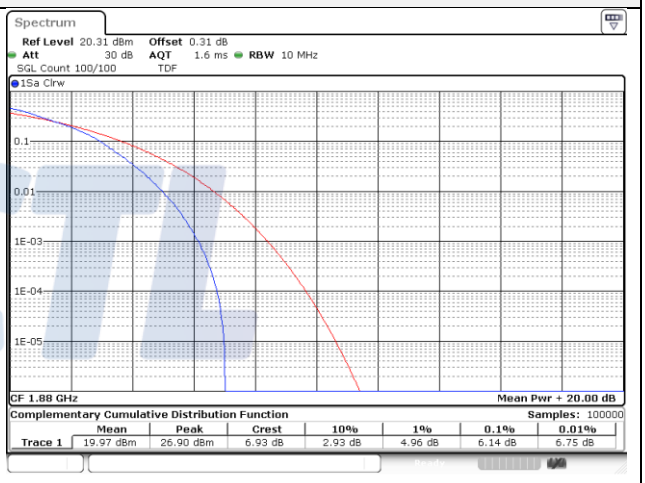

### 10M BW / 16QAM / Low ch.



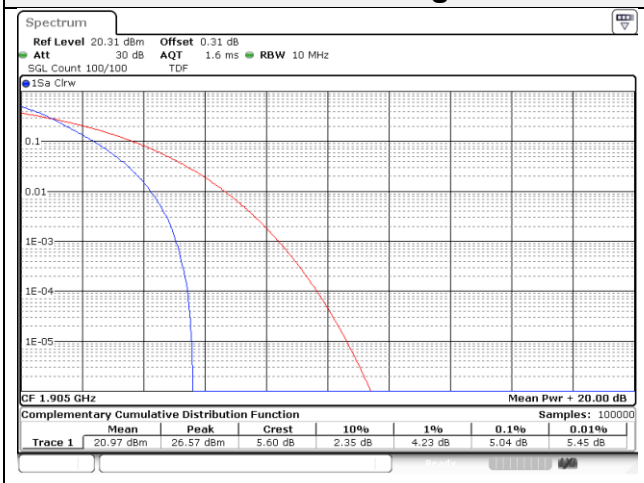

### 10M BW / QPSK / Mid ch.



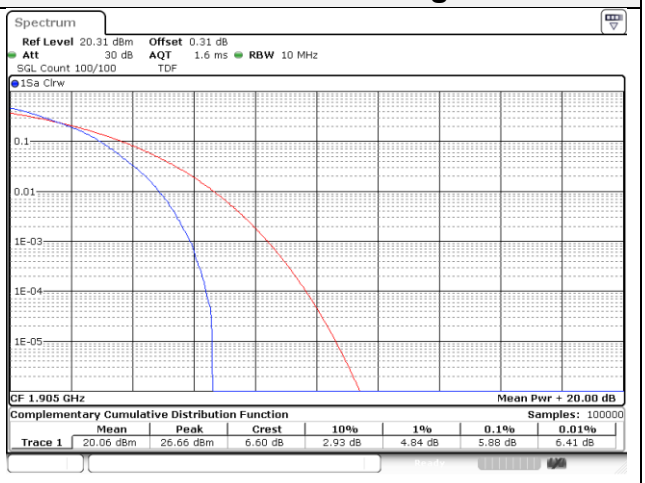

### 10M BW / 16QAM / Mid ch.



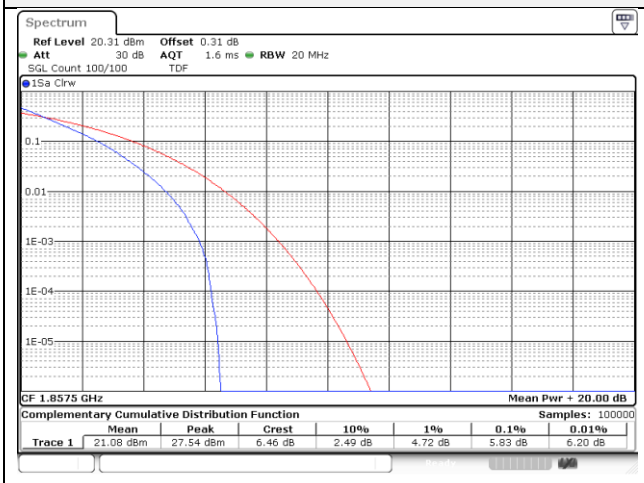

### 10M BW / QPSK / High ch.



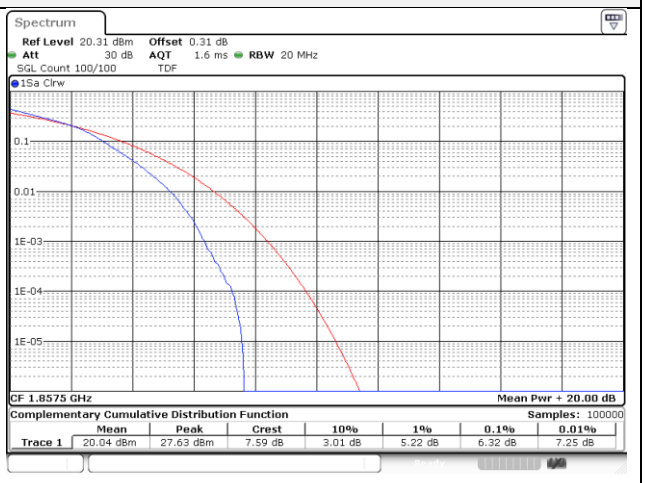

### 10M BW / 16QAM / High ch.



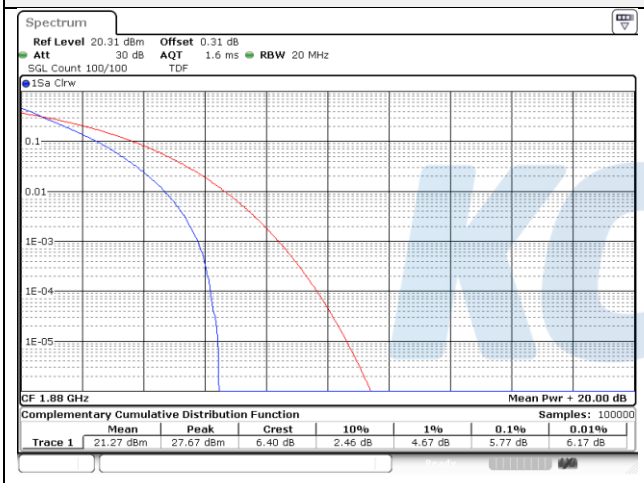
## 15M BW / QPSK / Low ch.



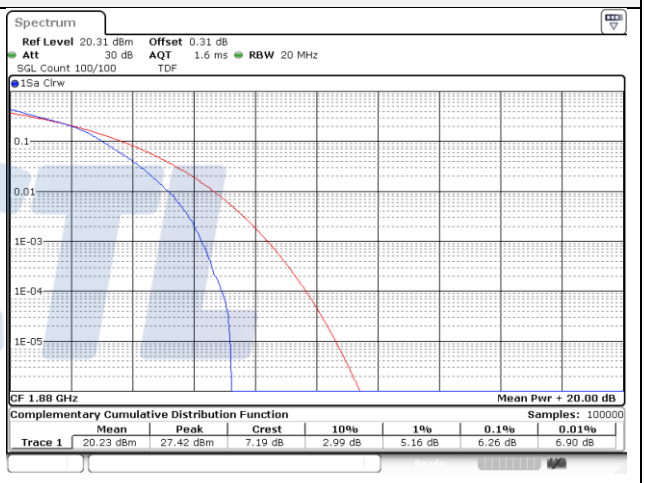

## 15M BW / 16QAM / Low ch.



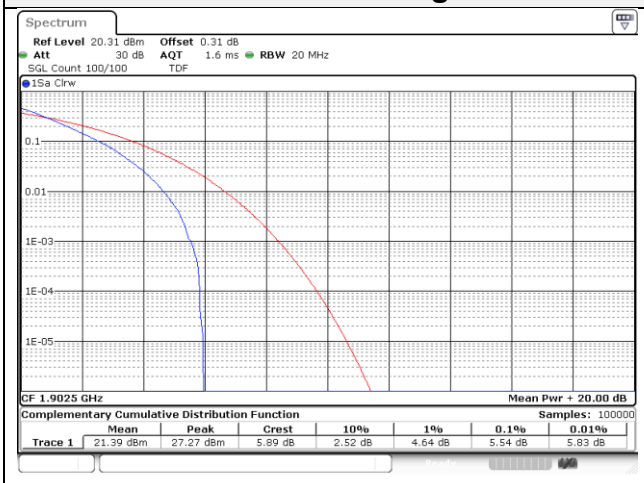

## 15M BW / QPSK / Mid ch.



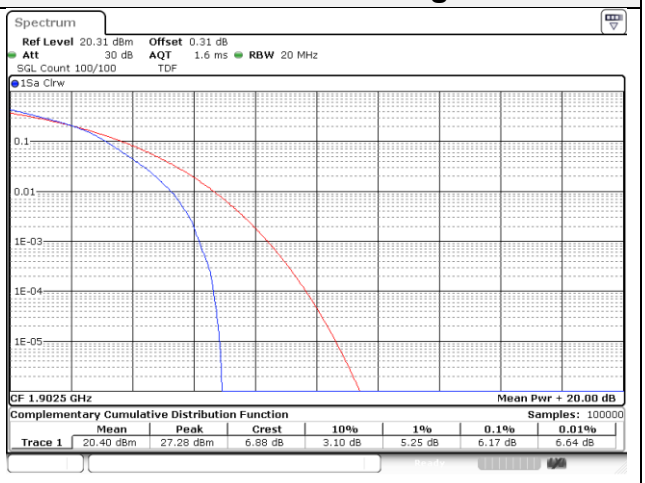

## 15M BW / 16QAM / Mid ch.



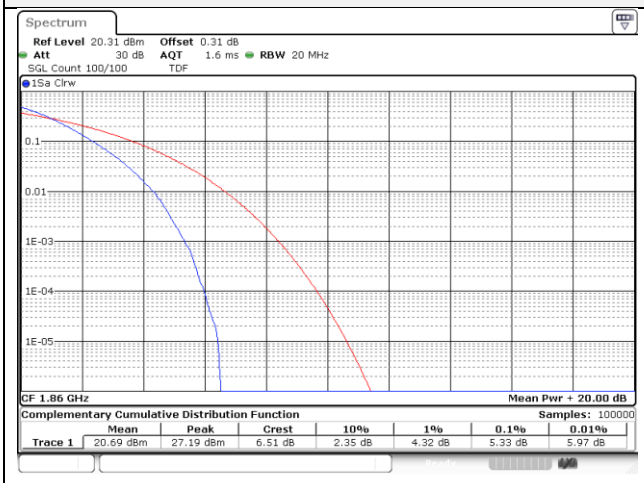

## 15M BW / QPSK / High ch.



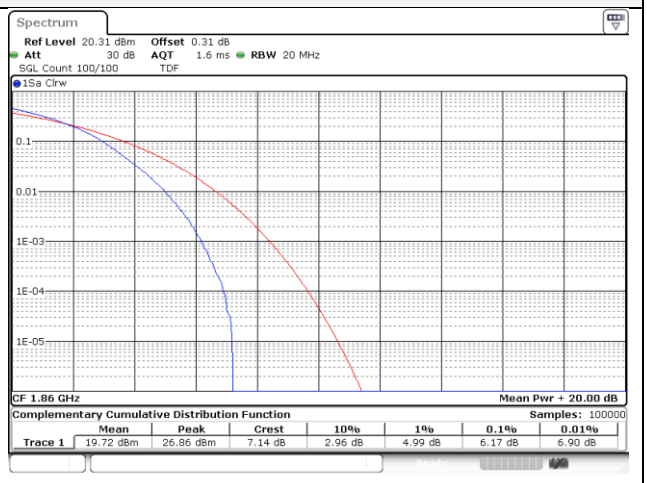

## 15M BW / 16QAM / High ch.



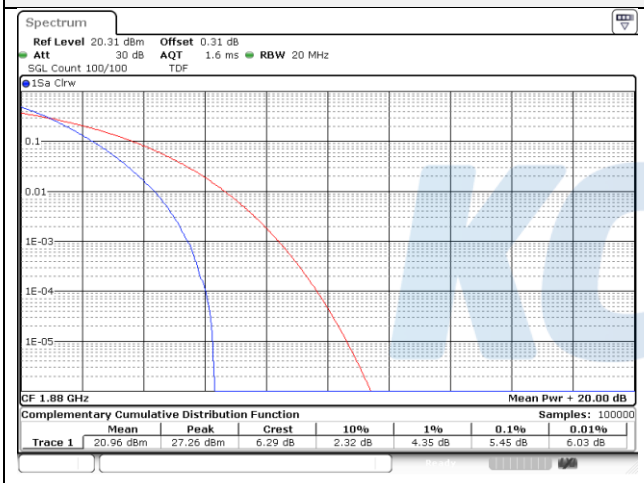
## 20M BW / QPSK / Low ch.



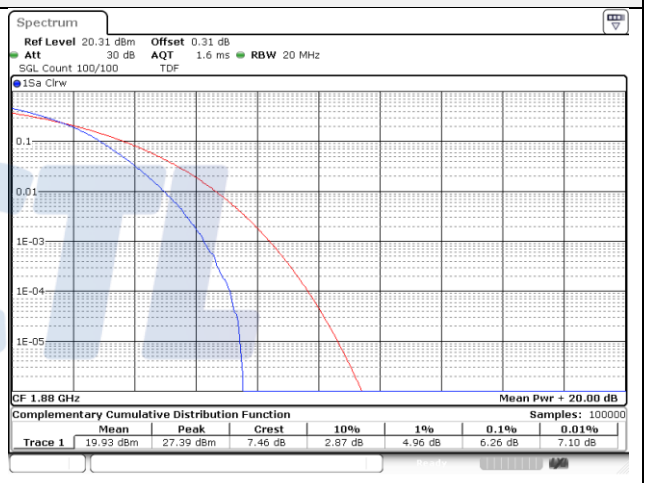

## 20M BW / 16QAM / Low ch.



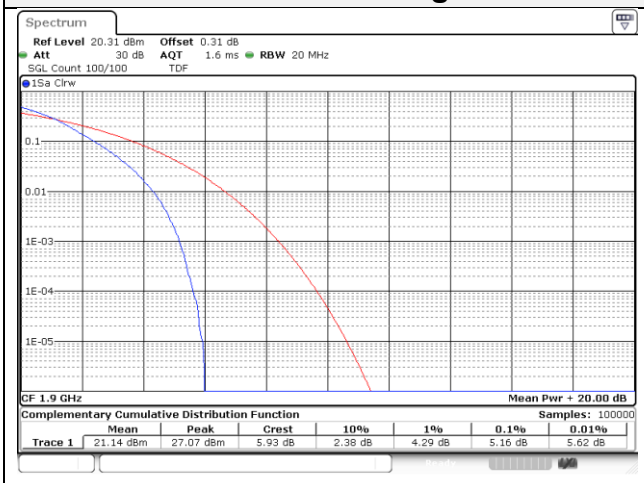

## 20M BW / QPSK / Mid ch.



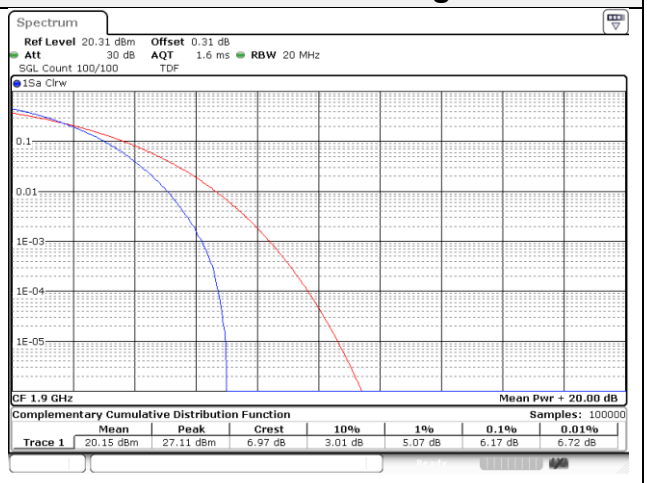

## 20M BW / 16QAM / Mid ch.




## 20M BW / QPSK / High ch.

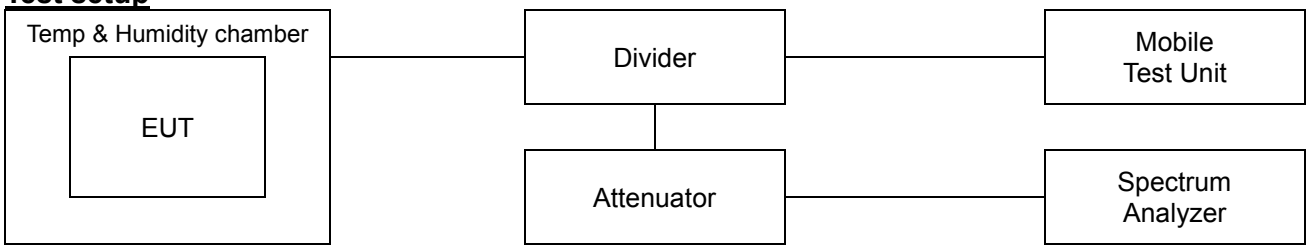



## 20M BW / 16QAM / High ch.



## 7.6. 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 §22.355,**

The carrier frequency of each transmitter in the public mobile services must be maintained within the tolerances given in Table of this section.

For mobile devices operating in the 824 to 849 ㎒ band at a power level than or equal to 3 Watts, the limit specified in Table C-1 is ±2.5 ppm.

**According to §24.235,**

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

**According to §27.54,**

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the Authorized bands of operation.

**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.

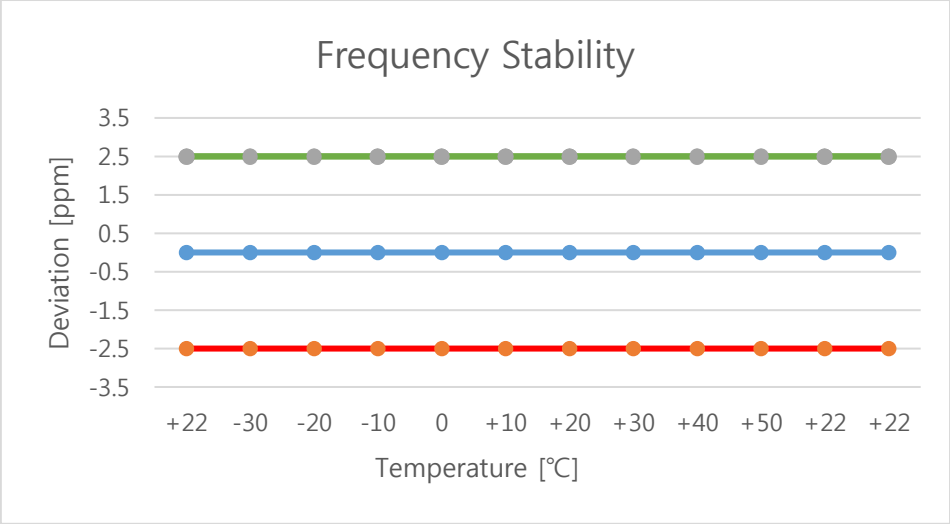
**Notes:**

1. All path loss of frequency range was investigated and compensated to spectrum analyzer as TDF function. Please refer to the page 10.

## Test results

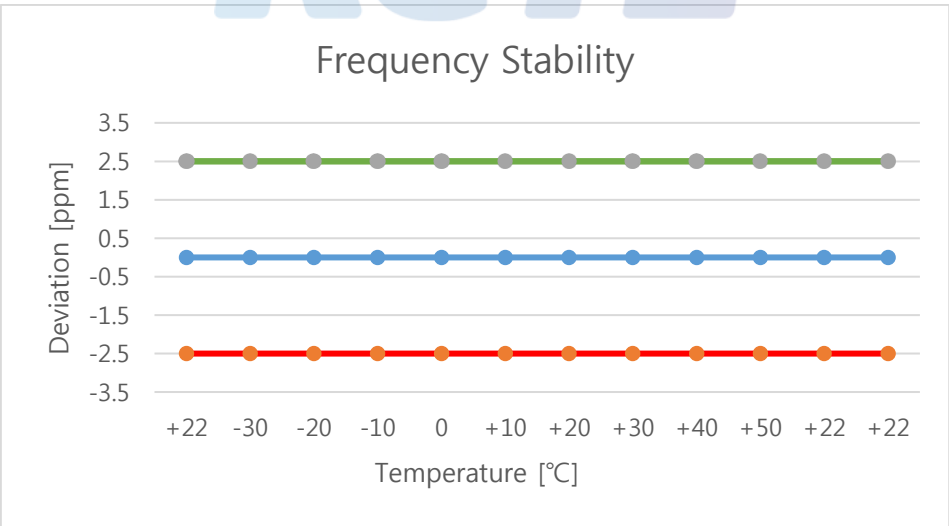
Test mode : LTE Band5
Frequency (㎐) : 836 500 000
Channel : 20525
Deviation limit : ±0.00025% or 2.5ppm

| Voltage (%) | Power (V) | Temp. (°C) | Frequency (㎐) | Frequency error (㎐) | Deviation | |
|---|---|---|---|---|---|---|
| | | | | | (ppm) | (%) |
| 100% | 3.85 | +22(Ref) | 836 500 002 | 1.59 | 0.0 | 0.000 000 |
| | | -30 | 836 499 999 | -1.49 | 0.0 | 0.000 000 |
| | | -20 | 836 500 000 | 0.47 | 0.0 | 0.000 000 |
| | | -10 | 836 500 001 | 1.43 | 0.0 | 0.000 000 |
| | | 0 | 836 499 998 | -1.73 | 0.0 | 0.000 000 |
| | | +10 | 836 499 998 | -2 | 0.0 | 0.000 000 |
| | | +20 | 836 500 002 | 1.66 | 0.0 | 0.000 000 |
| | | +30 | 836 500 001 | 0.83 | 0.0 | 0.000 000 |
| | | +40 | 836 500 000 | -0.29 | 0.0 | 0.000 000 |
| | | +50 | 836 500 000 | 0.2 | 0.0 | 0.000 000 |
| 115% | 4.43 | +22(Ref) | 836 500 000 | 0.11 | 0.0 | 0.000 000 |
| End point | 3.55 | +22(Ref) | 836 500 001 | 0.51 | 0.0 | 0.000 000 |



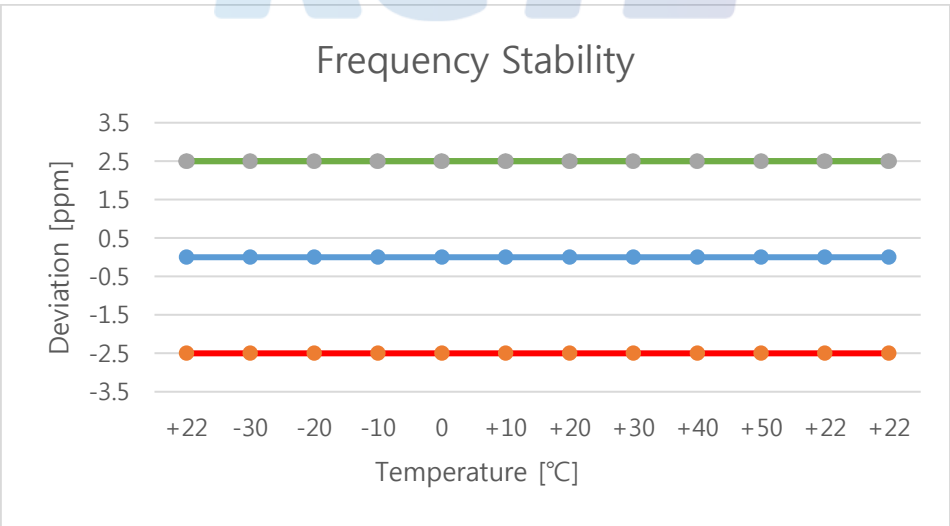
Test mode : LTE Band2
Frequency (㎐) : 1 880 000 000
Channel : 18900
Deviation limit : ±0.00025% or 2.5ppm

| Voltage (%) | Power (V) | Temp. (°C) | Frequency (㎐) | Frequency error (㎐) | Deviation | |
|---|---|---|---|---|---|---|
| | | | | | (ppm) | (%) |
| 100% | 3.85 | +22(Ref) | 1 880 000 002 | 2.13 | 0.0 | 0.000 000 |
| | | -30 | 1 879 999 999 | -0.83 | 0.0 | 0.000 000 |
| | | -20 | 1 880 000 002 | 1.6 | 0.0 | 0.000 000 |
| | | -10 | 1 880 000 002 | 2.47 | 0.0 | 0.000 000 |
| | | 0 | 1 880 000 000 | -0.37 | 0.0 | 0.000 000 |
| | | +10 | 1 880 000 001 | 1.27 | 0.0 | 0.000 000 |
| | | +20 | 1 880 000 001 | 1.33 | 0.0 | 0.000 000 |
| | | +30 | 1 880 000 002 | 2.35 | 0.0 | 0.000 000 |
| | | +40 | 1 880 000 003 | 2.7 | 0.0 | 0.000 000 |
| | | +50 | 1 880 000 002 | 2.16 | 0.0 | 0.000 000 |
| 115% | 4.43 | +22(Ref) | 1 880 000 003 | 3.19 | 0.0 | 0.000 000 |
| End point | 3.55 | +22(Ref) | 1 880 000 003 | 3.12 | 0.0 | 0.000 000 |



Test mode : LTE Band41
Frequency (㎐) : 2 593 000 000
Channel : 20175
Deviation limit : ±0.00025% or 2.5ppm

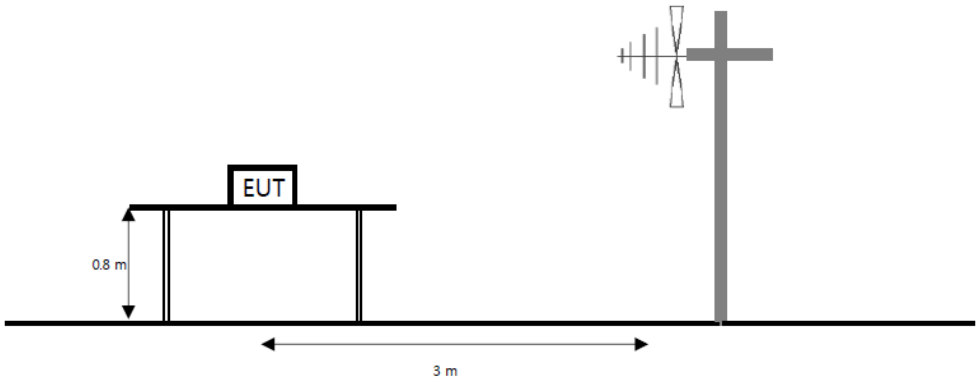
| Voltage (%) | Power (V) | Temp. (°C) | Frequency (㎐) | Frequency error (㎐) | Deviation | |
|---|---|---|---|---|---|---|
| | | | | | (ppm) | (%) |
| 100% | 3.85 | +22(Ref) | 2 593 000 002 | 1.9 | 0.0 | 0.000 000 |
| | | -30 | 2 593 000 004 | 3.6 | 0.0 | 0.000 000 |
| | | -20 | 2 593 000 002 | 1.7 | 0.0 | 0.000 000 |
| | | -10 | 2 593 000 003 | 2.9 | 0.0 | 0.000 000 |
| | | 0 | 2 593 000 004 | 3.7 | 0.0 | 0.000 000 |
| | | +10 | 2 593 000 003 | 3.3 | 0.0 | 0.000 000 |
| | | +20 | 2 593 000 005 | 5.2 | 0.0 | 0.000 000 |
| | | +30 | 2 593 000 001 | 1.4 | 0.0 | 0.000 000 |
| | | +40 | 2 593 000 002 | 1.9 | 0.0 | 0.000 000 |
| | | +50 | 2 593 000 005 | 4.5 | 0.0 | 0.000 000 |
| 115% | 4.43 | +22(Ref) | 2 593 000 005 | 5.4 | 0.0 | 0.000 000 |
| End point | 3.55 | +22(Ref) | 2 593 000 004 | 3.5 | 0.0 | 0.000 000 |



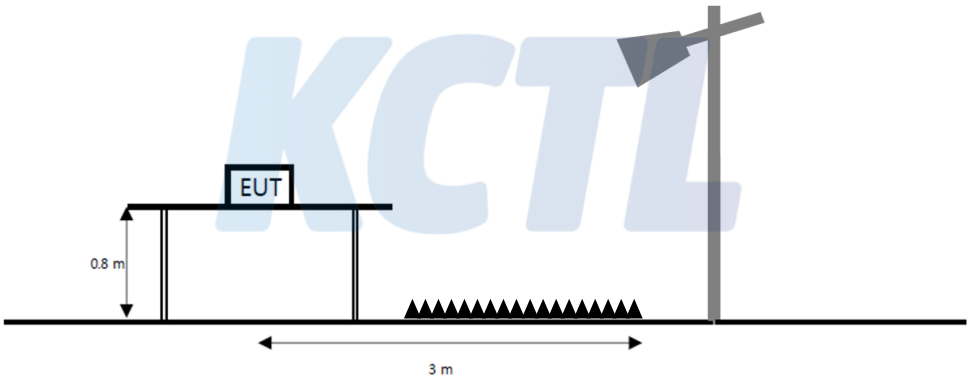
## 7.7. Radiated Power (ERP/EIRP)

**Test setup**

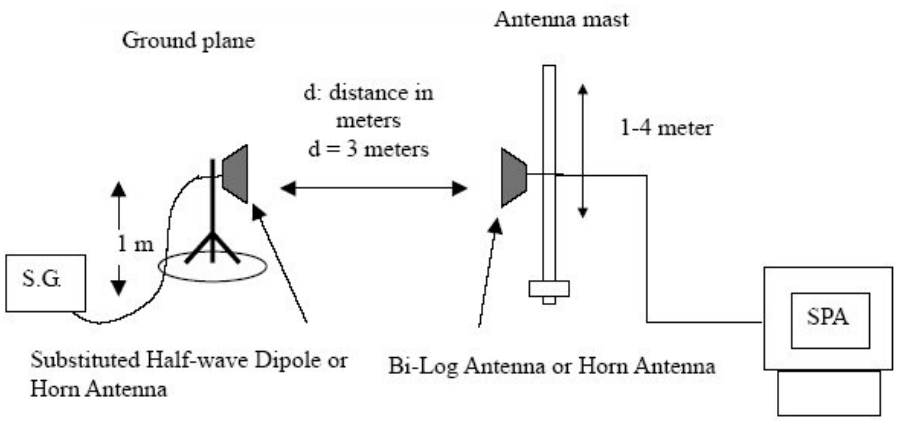
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.




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 §22.913(a)(5), the ERP of transmitters in the cellular radiotelephone service must not exceed the limits in this section. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to §24.232(c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

According to §27.50(h)(2), mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

**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 Band5

| Bandwidth | Modulation | Frequency | Pol. | Antenna Gain | C.L | Substitute Level | ERP | |
|---|---|---|---|---|---|---|---|---|
| | | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [W] |
| 1.4 M | QPSK | 824.70 | H | -0.60 | 3.80 | 24.76 | 20.36 | 0.109 |
| | | 836.50 | H | -0.50 | 3.84 | 25.62 | 21.28 | 0.134 |
| | | 848.30 | H | -0.50 | 3.87 | 24.62 | 20.25 | 0.106 |
| | 16QAM | 824.70 | H | -0.60 | 3.80 | 23.98 | 19.58 | 0.091 |
| | | 836.50 | H | -0.50 | 3.84 | 24.67 | 20.33 | 0.108 |
| | | 848.30 | H | -0.50 | 3.87 | 23.68 | 19.31 | 0.085 |
| 3 M | QPSK | 825.50 | H | -0.60 | 3.80 | 25.43 | 21.03 | 0.127 |
| | | 836.50 | H | -0.50 | 3.84 | 25.66 | 21.32 | 0.136 |
| | | 847.50 | H | -0.50 | 3.87 | 24.38 | 20.01 | 0.100 |
| | 16QAM | 825.50 | H | -0.60 | 3.80 | 24.27 | 19.87 | 0.097 |
| | | 836.50 | H | -0.50 | 3.84 | 24.34 | 20.00 | 0.100 |
| | | 847.50 | H | -0.50 | 3.87 | 23.67 | 19.30 | 0.085 |
| 5 M | QPSK | 826.50 | H | -0.60 | 3.80 | 25.67 | 21.27 | 0.134 |
| | | 836.50 | H | -0.50 | 3.84 | 25.84 | 21.50 | 0.141 |
| | | 846.50 | H | -0.50 | 3.87 | 25.06 | 20.69 | 0.117 |
| | 16QAM | 826.50 | H | -0.60 | 3.80 | 24.63 | 20.23 | 0.105 |
| | | 836.50 | H | -0.50 | 3.84 | 24.91 | 20.57 | 0.114 |
| | | 846.50 | H | -0.50 | 3.87 | 23.77 | 19.40 | 0.087 |
| 10 M | QPSK | 829.00 | H | -0.60 | 3.80 | 25.61 | 21.21 | 0.132 |
| | | 836.50 | H | -0.50 | 3.84 | 25.78 | 21.44 | 0.139 |
| | | 844.00 | H | -0.50 | 3.87 | 25.21 | 20.84 | 0.121 |
| | 16QAM | 829.00 | H | -0.60 | 3.80 | 24.60 | 20.20 | 0.105 |
| | | 836.50 | H | -0.50 | 3.84 | 24.84 | 20.50 | 0.112 |
| | | 844.00 | H | -0.50 | 3.87 | 24.10 | 19.73 | 0.094 |

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

**Test mode: LTE Band2**

| Bandwidth | Modulation | Frequency | Pol. | Antenna Gain | C.L | Substitute Level | EIRP | |
|---|---|---|---|---|---|---|---|---|
| | | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [W] |
| 1.4 M | QPSK | 1 850.7 | H | 8.70 | 5.72 | 16.99 | 19.97 | 0.099 |
| | | 1 880.0 | H | 8.70 | 5.72 | 16.98 | 19.96 | 0.099 |
| | | 1 909.3 | H | 8.70 | 5.88 | 18.09 | 20.91 | 0.123 |
| | 16QAM | 1 850.7 | H | 8.70 | 5.72 | 15.83 | 18.81 | 0.076 |
| | | 1 880.0 | H | 8.70 | 5.72 | 15.95 | 18.93 | 0.078 |
| | | 1 909.3 | H | 8.70 | 5.88 | 14.80 | 17.62 | 0.058 |
| 3 M | QPSK | 1 851.5 | H | 8.70 | 5.72 | 17.88 | 20.86 | 0.122 |
| | | 1 880.0 | H | 8.70 | 5.72 | 18.96 | 21.94 | 0.156 |
| | | 1 908.5 | H | 8.70 | 5.88 | 18.05 | 20.87 | 0.122 |
| | 16QAM | 1 851.5 | H | 8.70 | 5.72 | 16.83 | 19.81 | 0.096 |
| | | 1 880.0 | H | 8.70 | 5.72 | 17.76 | 20.74 | 0.119 |
| | | 1 908.5 | H | 8.70 | 5.88 | 16.98 | 19.80 | 0.095 |
| 5 M | QPSK | 1 852.5 | H | 8.70 | 5.72 | 17.97 | 20.95 | 0.124 |
| | | 1 880.0 | H | 8.70 | 5.72 | 19.04 | 22.02 | 0.159 |
| | | 1 907.5 | H | 8.70 | 5.88 | 18.14 | 20.96 | 0.125 |
| | 16QAM | 1 852.5 | H | 8.70 | 5.72 | 17.13 | 20.11 | 0.103 |
| | | 1 880.0 | H | 8.70 | 5.72 | 17.76 | 20.74 | 0.119 |
| | | 1 907.5 | H | 8.70 | 5.88 | 16.94 | 19.76 | 0.095 |
| 10 M | QPSK | 1 855.0 | H | 8.70 | 5.72 | 18.09 | 21.07 | 0.128 |
| | | 1 880.0 | H | 8.70 | 5.72 | 19.02 | 22.00 | 0.158 |
| | | 1 905.0 | H | 8.70 | 5.88 | 18.49 | 21.31 | 0.135 |
| | 16QAM | 1 855.0 | H | 8.70 | 5.72 | 17.45 | 20.43 | 0.110 |
| | | 1 880.0 | H | 8.70 | 5.72 | 17.89 | 20.87 | 0.122 |
| | | 1 905.0 | H | 8.70 | 5.88 | 17.35 | 20.17 | 0.104 |
| 15 M | QPSK | 1 857.5 | H | 8.70 | 5.72 | 17.11 | 20.09 | 0.102 |
| | | 1 880.0 | H | 8.70 | 5.72 | 17.64 | 20.62 | 0.115 |
| | | 1 902.5 | H | 8.70 | 5.88 | 17.49 | 20.31 | 0.107 |
| | 16QAM | 1 857.5 | H | 8.70 | 5.72 | 16.00 | 18.98 | 0.079 |
| | | 1 880.0 | H | 8.70 | 5.72 | 16.90 | 19.88 | 0.097 |
| | | 1 902.5 | H | 8.70 | 5.88 | 16.55 | 19.37 | 0.086 |

| Bandwidth | Modulation | Frequency | Pol. | Antenna Gain | C.L | Substitute Level | EIRP | |
|---|---|---|---|---|---|---|---|---|
| | | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [W] |
| 20 M | QPSK | 1 860.0 | H | 8.70 | 5.72 | 17.03 | 20.01 | 0.100 |
| | | 1 880.0 | H | 8.70 | 5.72 | 17.43 | 20.41 | 0.110 |
| | | 1 900.0 | H | 8.70 | 5.88 | 17.39 | 20.21 | 0.105 |
| | 16QAM | 1 860.0 | H | 8.70 | 5.72 | 15.86 | 18.84 | 0.077 |
| | | 1 880.0 | H | 8.70 | 5.72 | 16.45 | 19.43 | 0.088 |
| | | 1 900.0 | H | 8.70 | 5.88 | 16.65 | 19.47 | 0.089 |

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

**Test mode: LTE Band41**

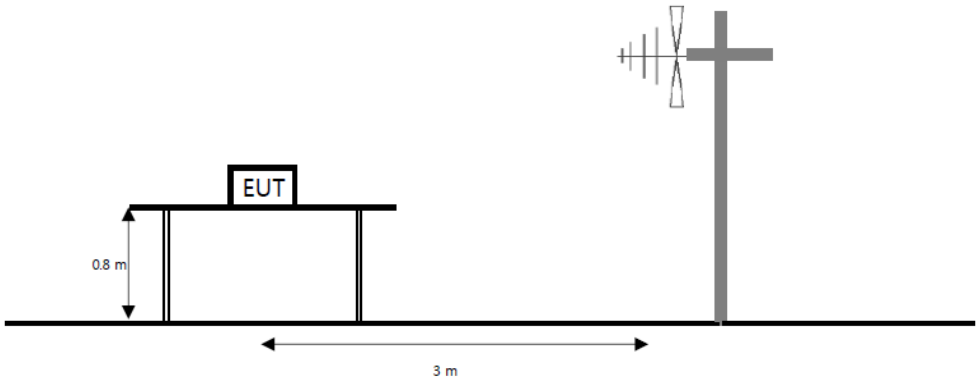
| Bandwidth | Modulation | Frequency | Pol. | Antenna Gain | C.L | Substitute Level | EIRP | |
|---|---|---|---|---|---|---|---|---|
| | | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [W] |
| 5 M | QPSK | 2 498.5 | V | 9.80 | 6.62 | 15.81 | 18.99 | 0.079 |
| | | 2 593.0 | V | 9.50 | 6.74 | 15.53 | 18.29 | 0.067 |
| | | 2 687.5 | V | 9.50 | 6.87 | 16.02 | 18.65 | 0.073 |
| | 16QAM | 2 498.5 | V | 9.80 | 6.62 | 12.91 | 16.09 | 0.041 |
| | | 2 593.0 | V | 9.50 | 6.74 | 13.40 | 16.16 | 0.041 |
| | | 2 687.5 | V | 9.50 | 6.87 | 14.56 | 17.19 | 0.052 |
| 10 M | QPSK | 2 501.0 | V | 9.80 | 6.74 | 16.15 | 19.21 | 0.083 |
| | | 2 593.0 | V | 9.50 | 6.74 | 15.20 | 17.96 | 0.063 |
| | | 2 685.0 | V | 9.50 | 6.87 | 15.87 | 18.50 | 0.071 |
| | 16QAM | 2 501.0 | V | 9.80 | 6.74 | 12.78 | 15.84 | 0.038 |
| | | 2 593.0 | V | 9.50 | 6.74 | 14.42 | 17.18 | 0.052 |
| | | 2 685.0 | V | 9.50 | 6.87 | 13.36 | 15.99 | 0.040 |
| 15 M | QPSK | 2 503.5 | V | 9.70 | 6.74 | 16.08 | 19.04 | 0.080 |
| | | 2 593.0 | V | 9.50 | 6.74 | 16.07 | 18.83 | 0.076 |
| | | 2 682.5 | V | 9.50 | 6.87 | 15.96 | 18.59 | 0.072 |
| | 16QAM | 2 503.5 | V | 9.70 | 6.74 | 14.48 | 17.44 | 0.055 |
| | | 2 593.0 | V | 9.50 | 6.74 | 13.06 | 15.82 | 0.038 |
| | | 2 682.5 | V | 9.50 | 6.87 | 12.36 | 14.99 | 0.032 |
| 20 M | QPSK | 2 506.0 | V | 9.80 | 6.74 | 15.76 | 18.82 | 0.076 |
| | | 2 593.0 | V | 9.50 | 6.74 | 15.54 | 18.30 | 0.068 |
| | | 2 680.0 | V | 9.50 | 6.87 | 13.38 | 16.01 | 0.040 |
| | 16QAM | 2 506.0 | V | 9.80 | 6.74 | 15.22 | 18.28 | 0.067 |
| | | 2 593.0 | V | 9.50 | 6.74 | 13.17 | 15.93 | 0.039 |
| | | 2 680.0 | V | 9.50 | 6.87 | 11.31 | 13.94 | 0.025 |

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

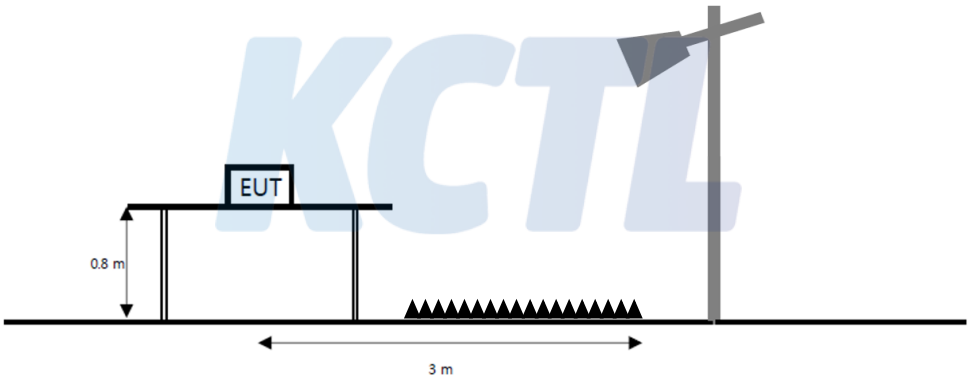
## 7.8. Radiated Spurious Emissions

**Test setup**

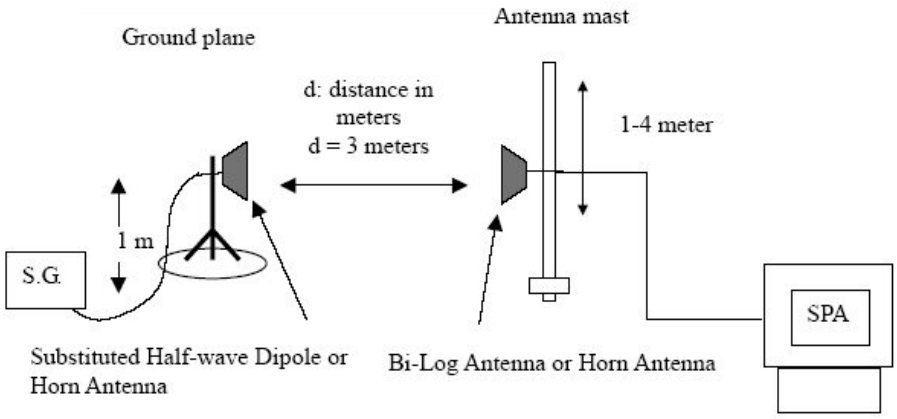
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.




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 §22.917(a), §24.238(a), 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 + 10log($P_{[Watts]}$) ㏈.

According to §27.53(m)(4), the minimum permissible attenuation level of any spurious emission is 53 + 10log($P_{[Watts]}$) ㏈.

**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.

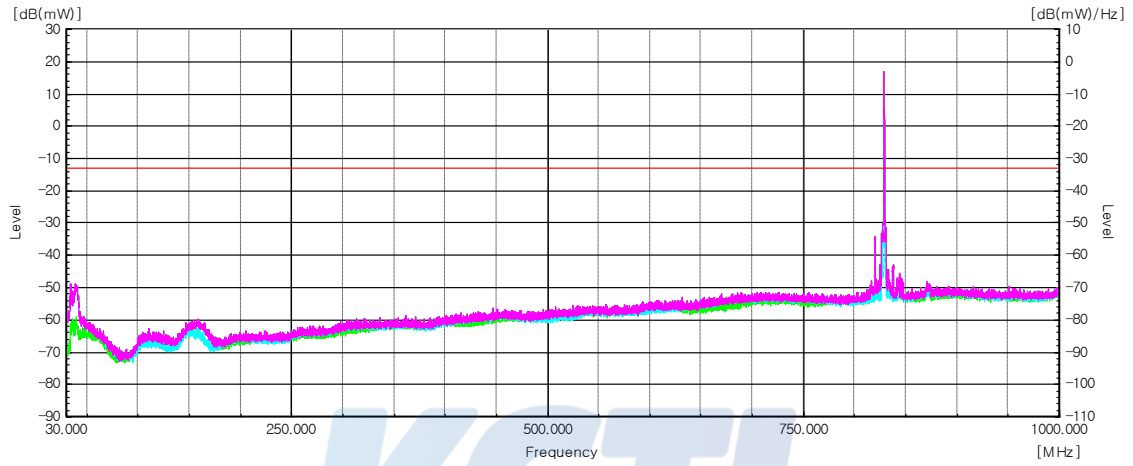
**Notes:**

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.

## Test results (Below 1 000 ㎒) – Worst case

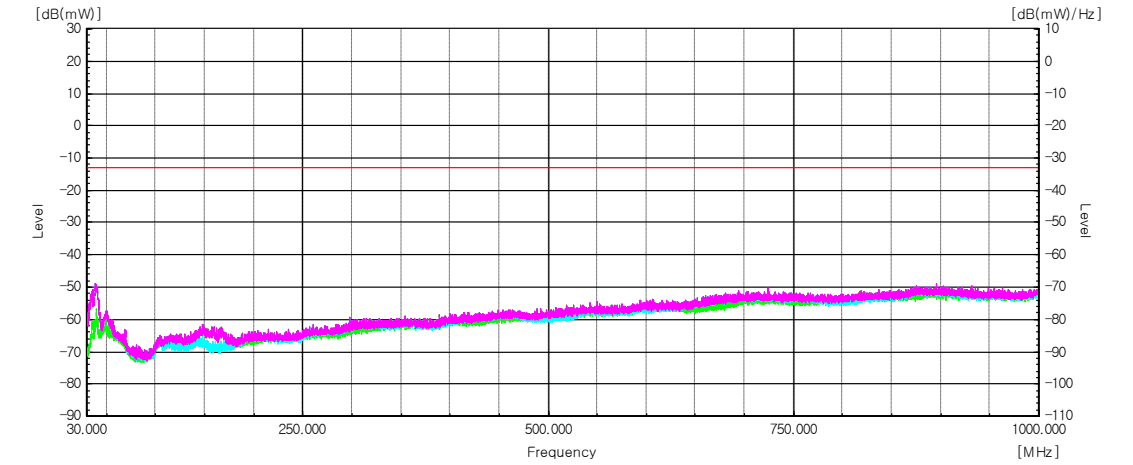
| | | |
|---|---|---|
| Test mode | : | LTE Band5 |
| Frequency (㎒) | : | 826.5 |
| Channel | : | 20525 |
| Bandwidth (㎒) | : | 5 |

**Horizontal/Vertical**




| | | |
|---|---|---|
| Test mode | : | LTE Band2 |
| Frequency (㎒) | : | 1 880.0 |
| Channel | : | 18900 |
| Bandwidth (㎒) | : | 5 |

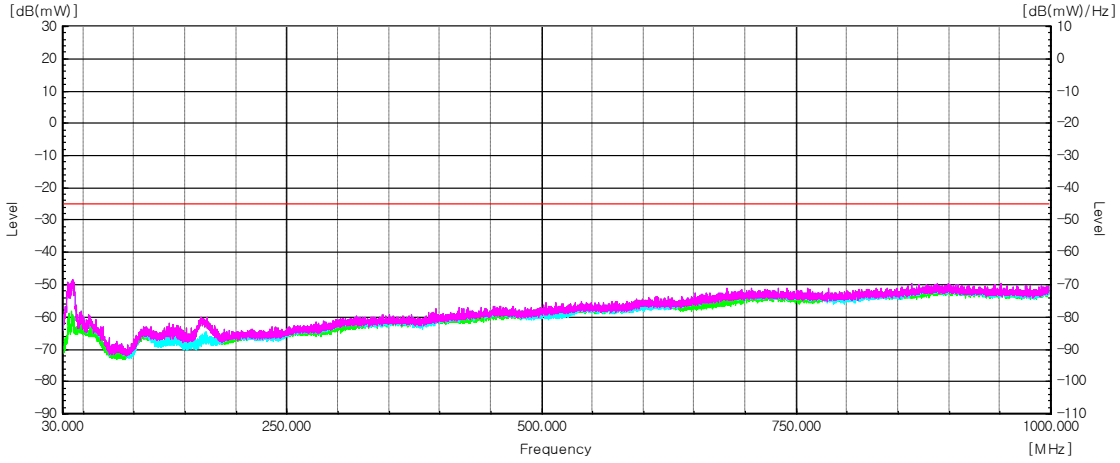
**Horizontal/Vertical**




Note.
1. No spurious emission were detected below 1 000 ㎒.

| | | |
|---|---|---|
| Test mode | : | LTE Band41 |
| Frequency (㎒) | : | 2 501.0 |
| Channel | : | 39700 |
| Bandwidth (㎒) | : | 10 |

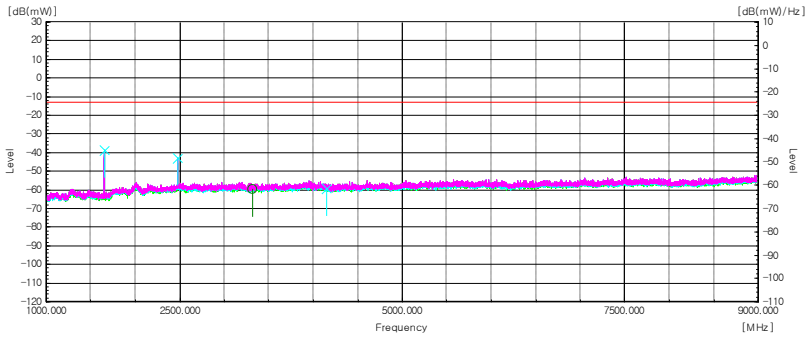
**Horizontal/Vertical**




Note.
1. No spurious emission were detected below 1 000 ㎒.

## Test results (Above 1 000 ㎒)

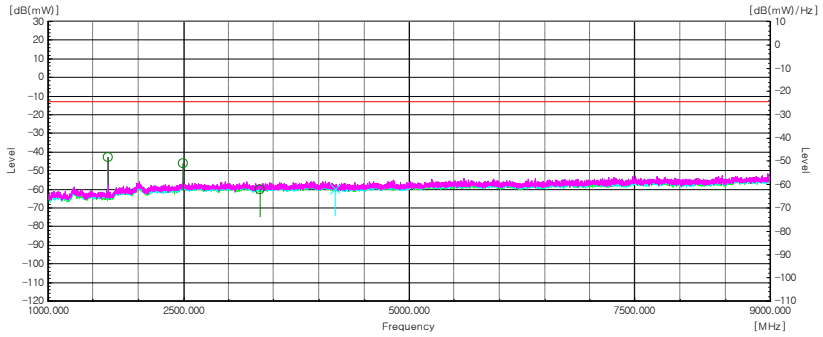
Test mode : LTE Band5
Frequency(㎒) : 826.5
Channel : 20425
Bandwidth(㎒) : 5




| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 1 649.08 | V | 8.4 | 5.38 | -41.92 | -38.90 | -13.00 | 25.90 |
| | 2 474.18 | V | 9.8 | 6.62 | -46.28 | -43.10 | -13.00 | 30.10 |
| | 3 316.29 | H | 9.3 | 7.78 | -61.12 | -59.60 | -13.00 | 46.60 |
| | 4 145.39 | V | 9.9 | 9.35 | -59.55 | -59.00 | -13.00 | 46.00 |

Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$) [dBc]

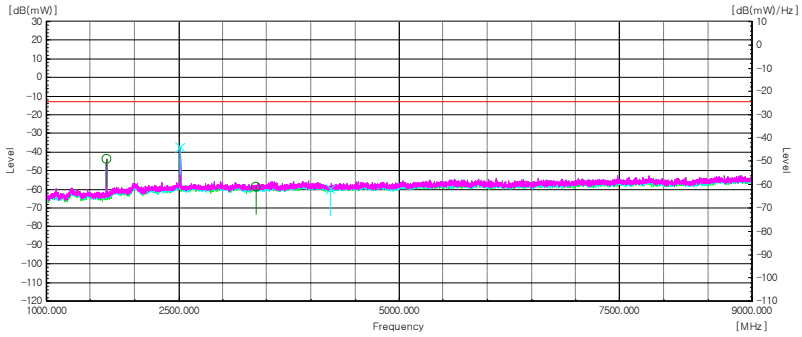
Test mode : LTE Band5
Frequency(㎒) : 836.5
Channel : 20525
Bandwidth(㎒) : 5




| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 1 664.08 | H | 8.5 | 5.38 | -46.22 | -43.10 | -13.00 | 30.10 |
| | 2 496.19 | H | 9.8 | 6.74 | -49.46 | -46.40 | -13.00 | 33.40 |
| | 3 346.29 | H | 9.3 | 7.78 | -61.62 | -60.10 | -13.00 | 47.10 |
| | 4 182.40 | V | 10.1 | 9.35 | -60.55 | -59.80 | -13.00 | 46.80 |

Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$) [dBc]

Test mode : LTE Band5
Frequency(㎒) : 846.5
Channel : 20625
Bandwidth(㎒) : 5

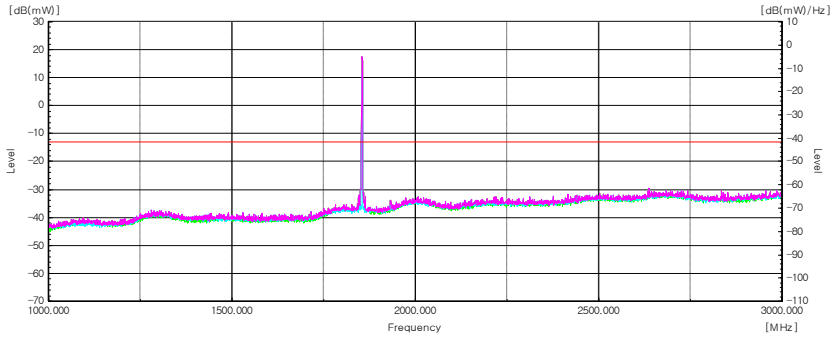



| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 1 679.09 | H | 8.6 | 5.38 | -46.92 | -43.70 | -13.00 | 30.70 |
| | 2 519.19 | V | 9.7 | 6.74 | -40.36 | -37.40 | -13.00 | 24.40 |
| | 3 376.30 | H | 9.2 | 7.78 | -60.42 | -59.00 | -13.00 | 46.00 |
| | 4 220.40 | V | 10.3 | 9.61 | -60.19 | -59.50 | -13.00 | 46.50 |

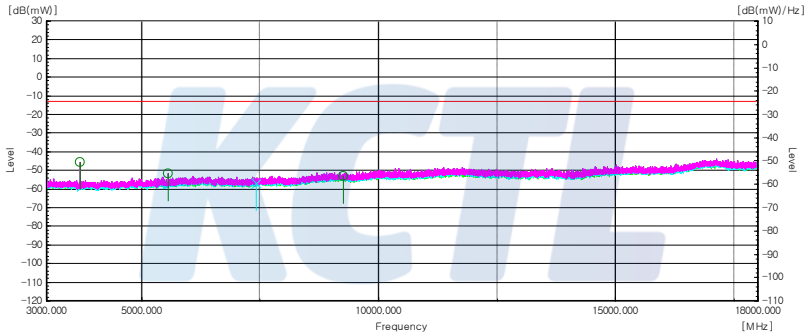
Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$) [dBc]

Test mode : LTE Band2
Frequency(㎒) : 1 852.5
Channel : 18625
Bandwidth(㎒) : 5

1 000 ㎒ to 3 000 ㎒




Above 3 000 ㎒

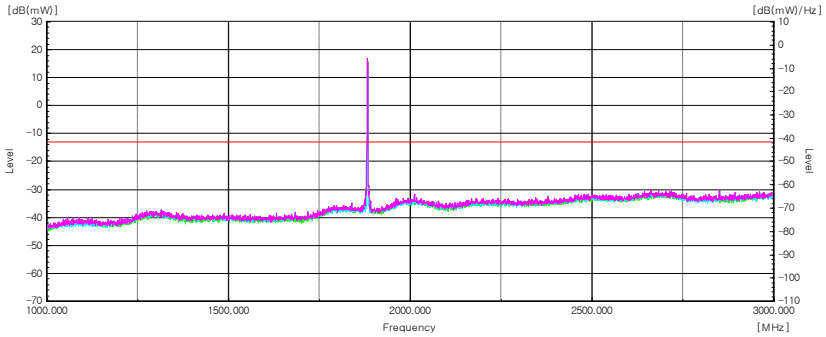



| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 3 709.05 | H | 9.6 | 8.920 | -46.280 | -45.600 | -13.000 | 32.600 |
| | 5 564.17 | H | 10.8 | 11.200 | -51.200 | -51.600 | -13.000 | 38.600 |
| | 7 410.29 | V | 10.8 | 13.240 | -54.460 | -56.900 | -13.000 | 43.900 |
| | 9 262.42 | H | 11.9 | 14.410 | -50.790 | -53.300 | -13.000 | 40.300 |

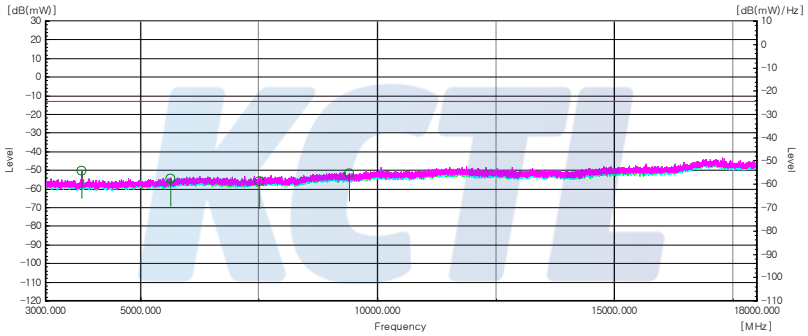
Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$) [dBc]
2. No spurious emission were detected 1 000 ㎒ to 3 000 ㎒.

Test mode : LTE Band2
Frequency(㎒) : 1 880.0
Channel : 18900
Bandwidth(㎒) : 5

1 000 ㎒ to 3 000 ㎒




Above 3 000 ㎒

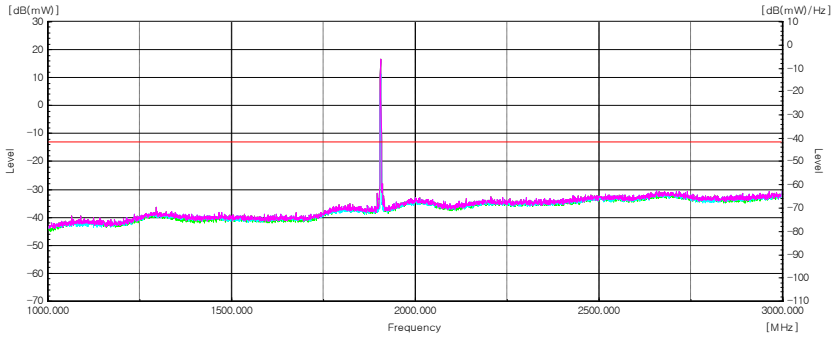



| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 3 756.05 | H | 9.3 | 8.92 | -50.98 | -50.60 | -13.00 | 37.60 |
| | 5 634.18 | H | 10.8 | 11.27 | -54.23 | -54.70 | -13.00 | 41.70 |
| | 7 520.30 | H | 11.0 | 13.24 | -53.56 | -55.80 | -13.00 | 42.80 |
| | 9 400.43 | H | 12.0 | 14.50 | -49.50 | -52.00 | -13.00 | 39.00 |

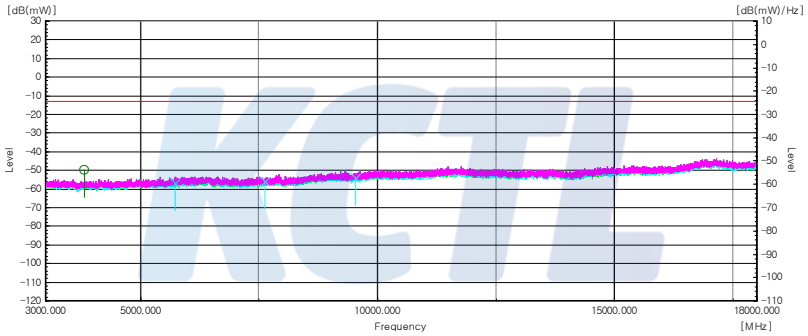
Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$) [dBc]
2. No spurious emission were detected 1 000 ㎒ to 3 000 ㎒.

Test mode : LTE Band2
Frequency(㎒) : 1 907.5
Channel : 19175
Bandwidth(㎒) : 5

1 000 ㎒ to 3 000 ㎒




Above 3 000 ㎒

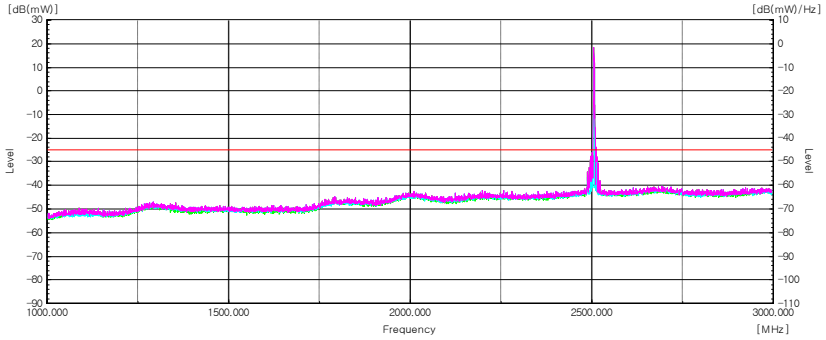



| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 3 819.06 | H | 9.1 | 9.04 | -13.06 | -13.00 | 36.90 | 329.60 |
| | 5 722.18 | V | 10.9 | 11.16 | -12.74 | -13.00 | 43.90 | 20.40 |
| | 7 630.31 | V | 11.3 | 13.24 | -11.06 | -13.00 | 43.00 | 20.40 |
| | 9 537.44 | V | 12.0 | 14.65 | -10.35 | -13.00 | 41.20 | 68.40 |

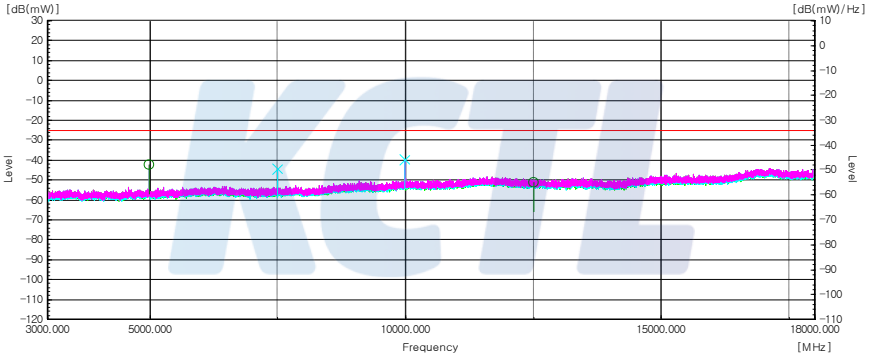
Note.
1. Limit Calculation(㏈m)= 43 + 10log($P_{[Watts]}$) [㏈c]
2. No spurious emission were detected 1 000 ㎒ to 3 000 ㎒.

Test mode : LTE Band41
Frequency(㎒) : 2 501.0
Channel : 39700
Bandwidth(㎒) : 10

1 000 ㎒ to 3 000 ㎒




Above 3 000 ㎒

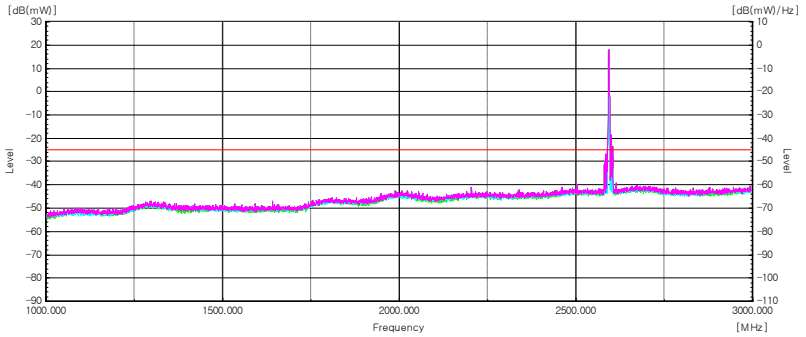



| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 4 993.13 | H | 10.9 | 10.46 | -42.94 | -42.50 | -25.00 | 17.50 |
| | 7 490.30 | V | 11.0 | 13.24 | -41.86 | -44.10 | -25.00 | 19.10 |
| | 9 986.47 | V | 12.2 | 14.88 | -37.12 | -39.80 | -25.00 | 14.80 |
| | 12 505.63 | H | 13.5 | 16.52 | -48.38 | -51.40 | -25.00 | 26.40 |

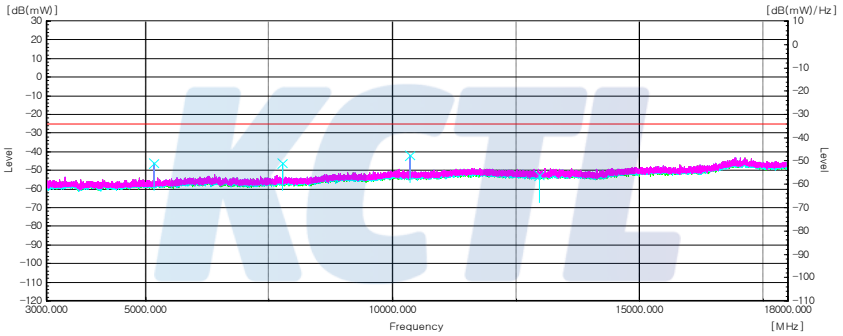
Note.
1. Limit Calculation(㏈m)= 55 + 10log($P_{[Watts]}$) [㏈c]
2. No spurious emission were detected 1 000 ㎒ to 3 000 ㎒.

Test mode : LTE Band41
Frequency(㎒) : 2 593.0
Channel : 40620
Bandwidth(㎒) : 10

1 000 ㎒ to 3 000 ㎒




Above 3 000 ㎒

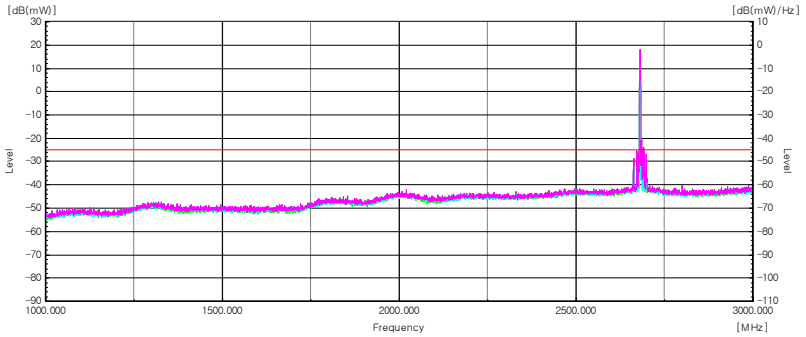



| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 5 177.15 | V | 10.9 | 10.63 | -46.57 | -46.30 | -25.00 | 21.30 |
| | 7 765.32 | V | 11.6 | 13.31 | -44.29 | -46.00 | -25.00 | 21.00 |
| | 10 354.49 | V | 12.6 | 15.06 | -39.44 | -41.90 | -25.00 | 16.90 |
| | 12 965.66 | V | 13.4 | 17.05 | -49.25 | -52.90 | -25.00 | 27.90 |

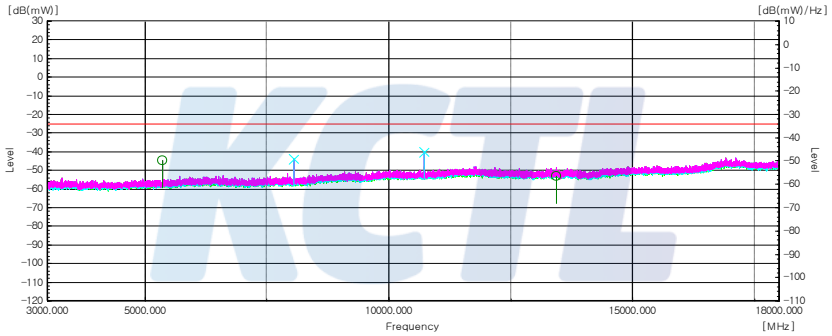
Note.
1. Limit Calculation(dBm)= 55 + 10log($P_{[Watts]}$) [dBc]
2. No spurious emission were detected 1 000 ㎒ to 3 000 ㎒.

Test mode : LTE Band41
Frequency(㎒) : 2 685.0
Channel : 41540
Bandwidth(㎒) : 10

1 000 ㎒ to 3 000 ㎒




Above 3 000 ㎒



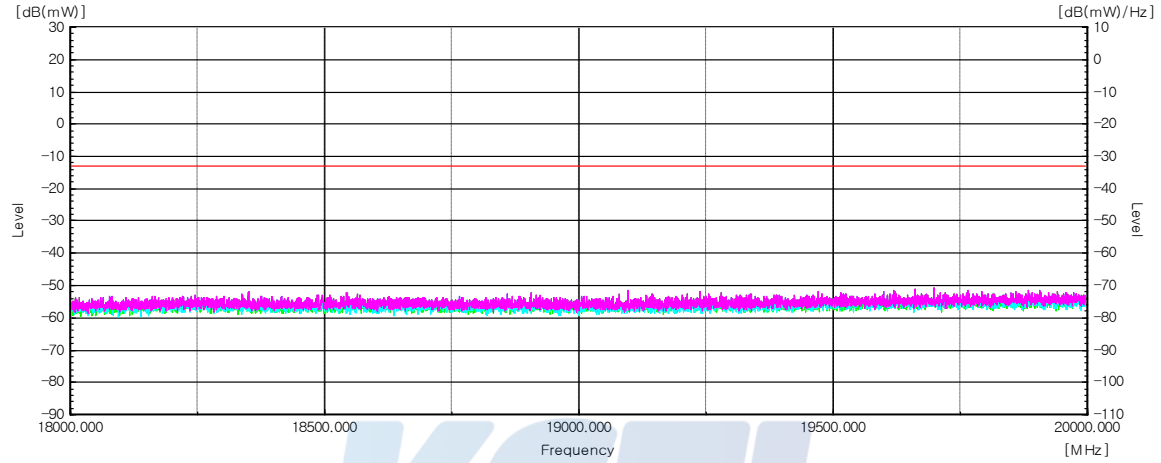

| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 5 361.16 | H | 11.1 | 10.88 | -45.12 | -44.90 | -25.00 | 19.90 |
| | 8 041.34 | V | 11.5 | 13.75 | -41.55 | -43.80 | -25.00 | 18.80 |
| | 10 722.51 | V | 12.8 | 15.40 | -37.40 | -40.00 | -25.00 | 15.00 |
| | 13 425.69 | H | 12.7 | 17.11 | -48.89 | -53.30 | -25.00 | 28.30 |

Note.
1. Limit Calculation(㏈m)= 55 + 10log($P_{[Watts]}$) [㏈c]
2. No spurious emission were detected 1 000 ㎒ to 3 000 ㎒.

## Test results (Above 18 ㎓) – Worst case

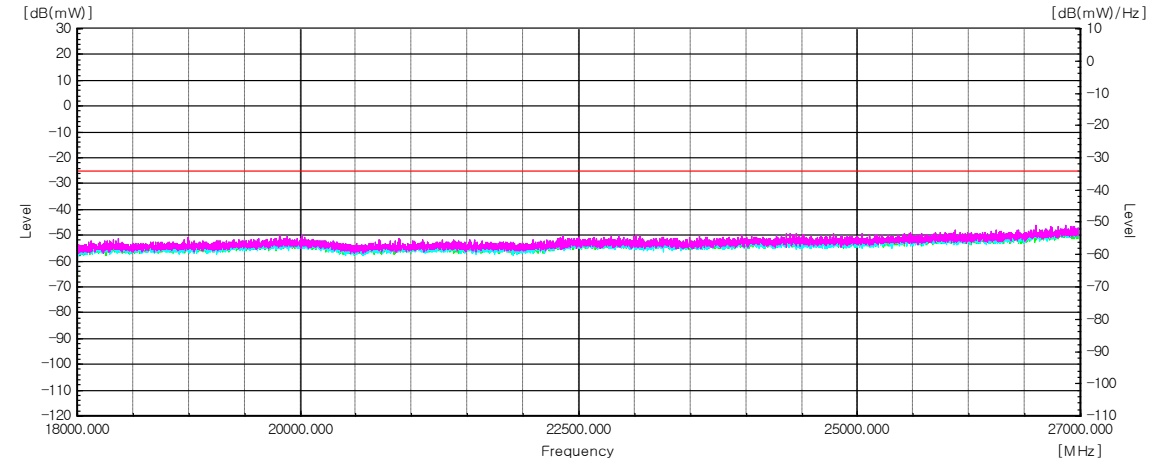
| | | |
|---|---|---|
| Test mode | : | LTE Band2 |
| Frequency (㎒) | : | 1 880.0 |
| Channel | : | 18900 |
| Bandwidth(㎒) | : | 5 |

**Horizontal/Vertical**




| | | |
|---|---|---|
| Test mode | : | LTE Band41 |
| Frequency (㎒) | : | 2 501.0 |
| Channel | : | 39700 |
| Bandwidth(㎒) | : | 10 |

**Horizontal/Vertical**




Note.
1. No spurious emissions were detected above 18㎓.

## 8. Geo-location mechanism

The device uses a geo-location mechanism based on the cellular MCC codes in order to only enable certain LTE bands when the device is not in the USA.

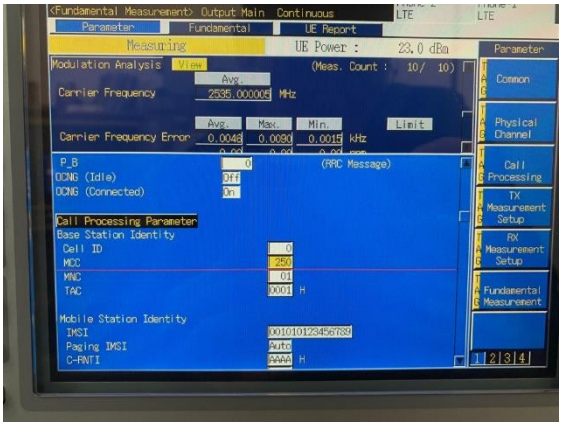
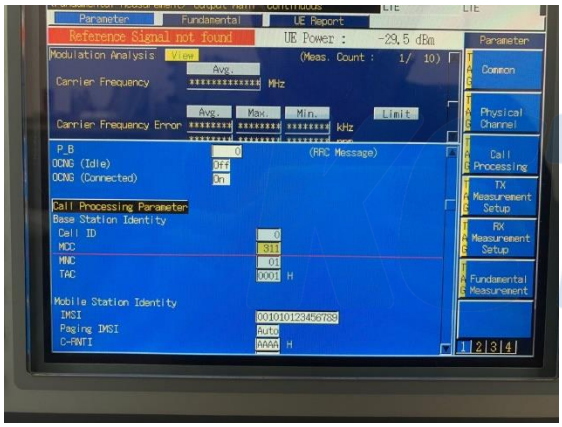
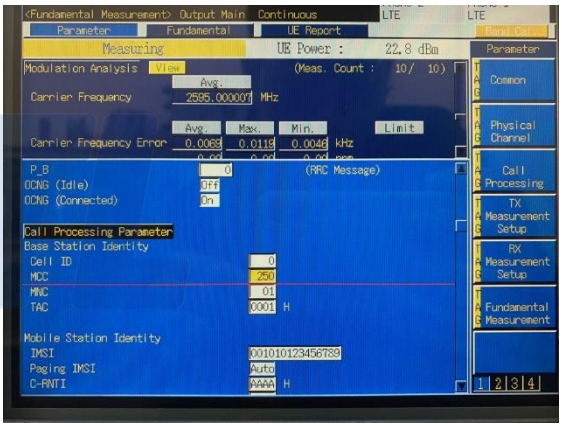
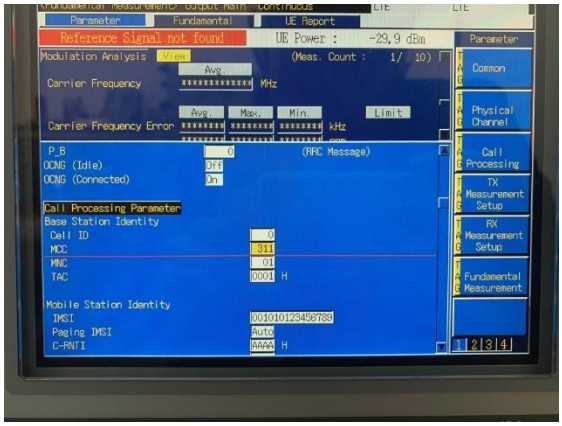
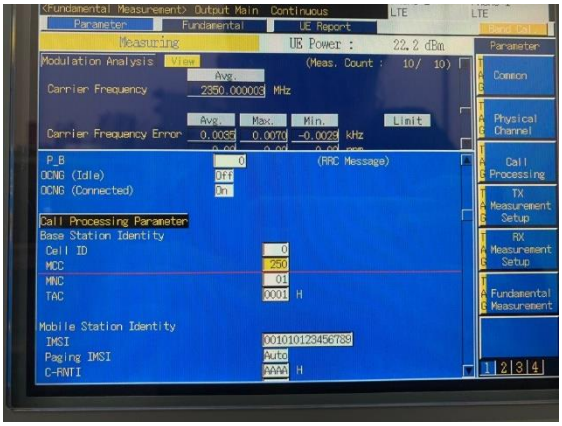
The validation of this mechanism is provided below.
The device was configured for cellular communications to a test set and the MCC code was adjusted on the test set between the US MCC and then an MCC code valid for a country where the LTE band is supported.

| Mode | MCC = USA | MCC = Non US |
|---|---|---|
| LTE Band7 | Not connected to USA | Connected to Russia |
| LTE Band38 | Not connected to USA | Connected to Russia |
| LTE Band40 | Not connected to USA | Connected to Russia |

Note.

1. The verification tests confirmed the operational of the geo-location mechanism.

## Test results

| Mode | MCC = USA | MCC = Non US |
|---|---|---|
| LTE Band7 |  |  |
| LTE Band38 |  |  |
| LTE Band40 |  |  |

## 9. Measurement equipment

| Equipment Name | Manufacturer | Model No. | Serial No. | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | R & S | FSV30 | 100810 | 19.08.01 |
| Spectrum Analyzer | AGILENT | N9040B | MY57010132 | 19.10.12 |
| Power Divider | Aeroflex/ Weinschel, Inc. | 1580-1 | NX380 | 19.08.02 |
| DC Power Supply | Agilent | E3632A | MY40018781 | 19.05.14 |
| Wideband Radio Communication Tester | R & S | CMW500 | 102159 | 19.08.08 |
| Wideband Radio Communication Tester | R & S | CMW500 | 102572 | 19.09.21 |
| Radio Communication Analyzer | Anritsu | MT8820C | 6201010005 | 19.08.02 |
| High pass Filter | Wainwright Instruments GmbH | WHKX3.0/18G-12SS | 44 | 20.01.25 |
| High pass Filter | Wainwright Instruments GmbH | WHKX1.0/1.5S-10SS | 14 | 20.01.25 |
| Attenuator | Weinschel ENGINEERING | 10 | AJ1239 | 19.05.14 |
| ATTENUATOR | API Inmet | 40AH2W-10 | 14 | 19.05.17 |
| Biconical VHF-UHF Broadband Antenna | SCHWARZBECK | VUBA9117 | 275 | 20.04.13 |
| Horn Antenna | ETS.lindgren | 3115 | 62589 | 19.08.24 |
| Horn Antenna | ETS.lindgren | 3116 | 00086635 | 19.05.10 |
| Horn Antenna | Steatite Antennas | QMS-00225 | 17790 | 19.08.24 |
| Bilog Antenna | Teseq GmbH | CBL 6143A | 35039 | 19.05.19 |
| Horn Antenna | ETS.lindgren | 3117 | 161225 | 19.05.18 |
| Amplifier | SONOMA INSTRUMENT | 317 | 321041 | 20.01.04 |
| Amplifier | L-3 Narda-MITEQ | AFS5-00101800-25-S-5 | 2054570 | 19.10.18 |
| Amplifier | L-3 Narda-MITEQ | JS44-18004000-33-8P | 2000997 | 19.08.02 |
| RF Selector | TOYO Corporation | NS5800 | 1003-010 | N/A |
| Band Selector | TOYO Corporation | NS5800 | 1003-135 | N/A |
| Band Selector | TOYO Corporation | NS5800 | 1003-320 | N/A |
| 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 |
| Cable Assembly | Radiall | R286303620 | 1649.241 | N/A |
| Cable Assembly | Radiall | TESTPRO 3 | - | N/A |

**End of test report**