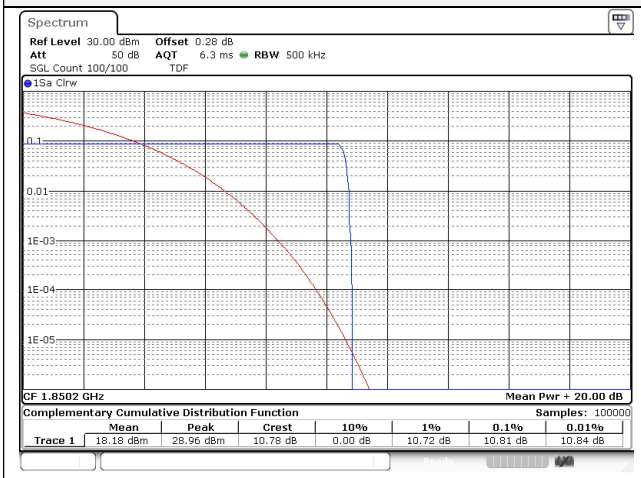
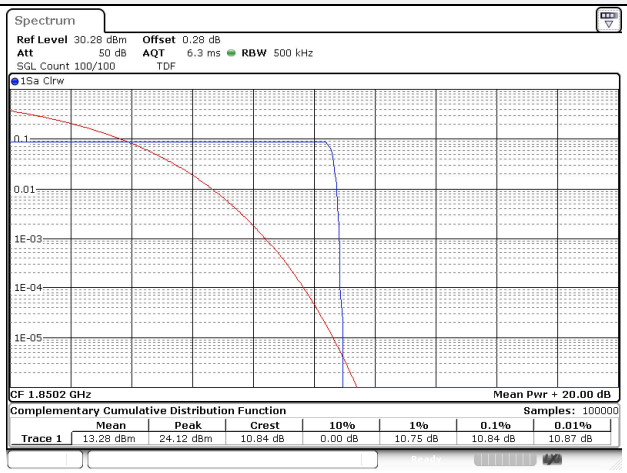
Test mode: GSM 1900

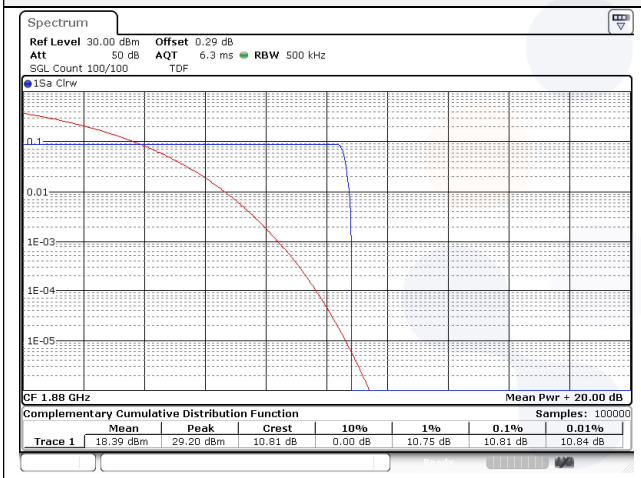
Voice Low ch.



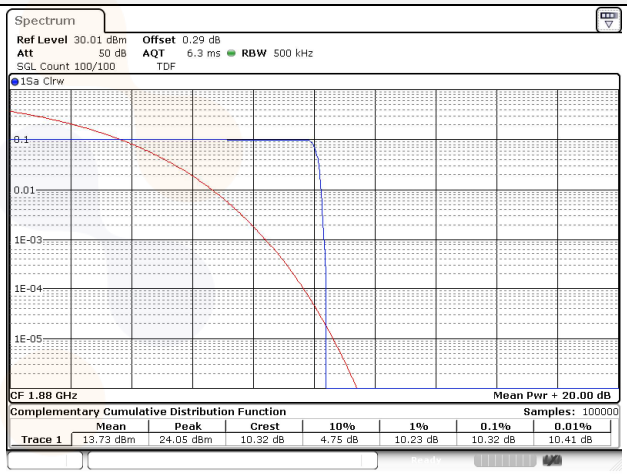
EDGE Low ch.



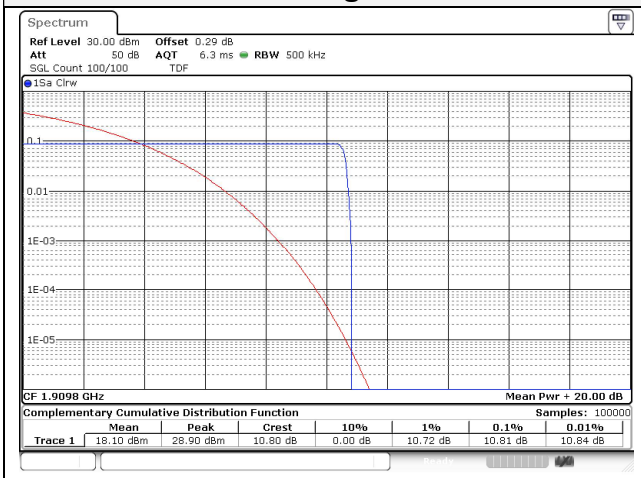
Voice Mid ch.



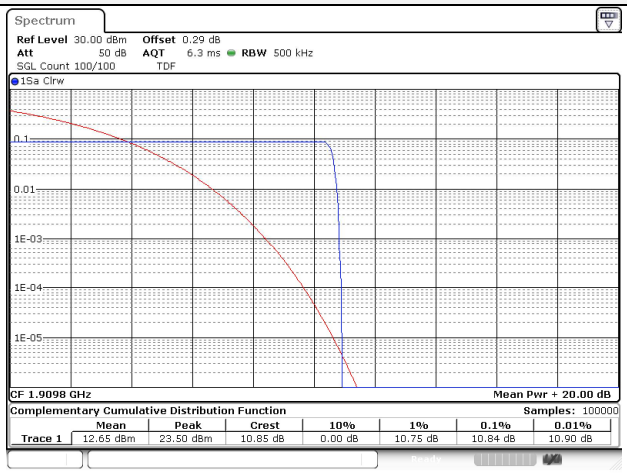
EDGE Mid ch.



Voice High ch.

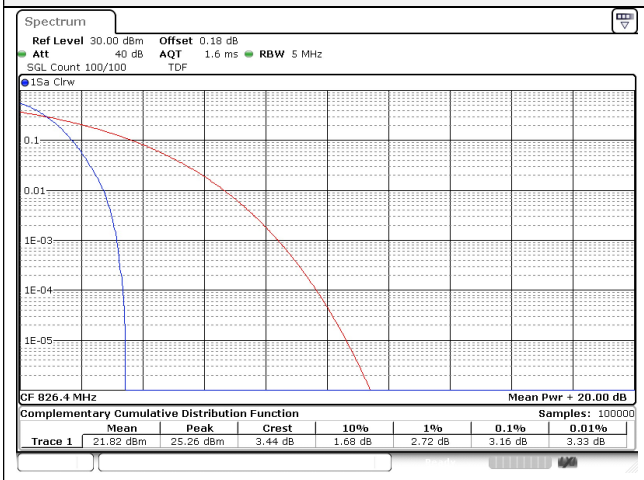


EDGE High ch.

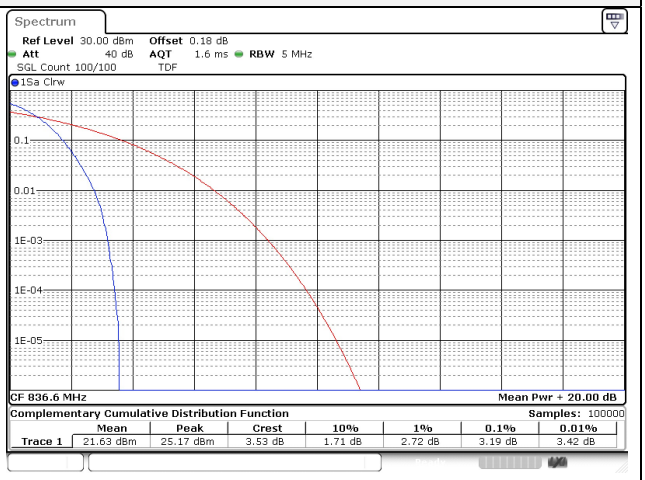


Test mode: WCDMA 850

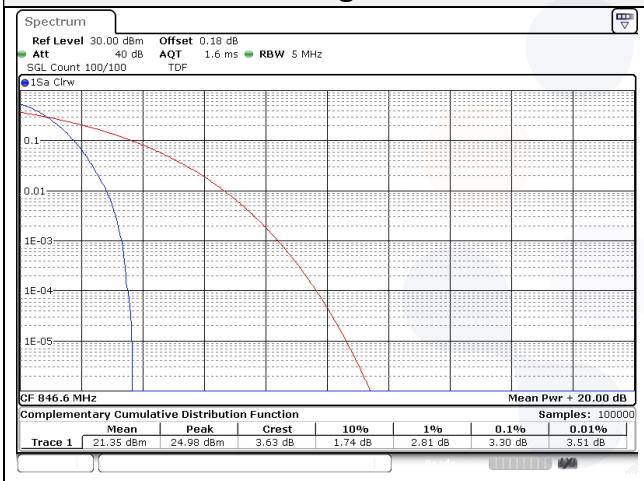
RMC Low ch.



RMC Mid ch.



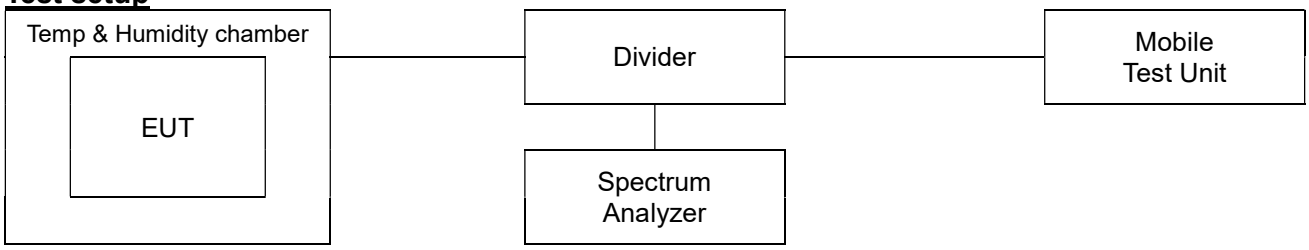
RMC High ch.



Blank

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.

The carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and ±1.0 ppm for base stations.

Test procedure

ANSI 63.26-2015 – Section 5.6

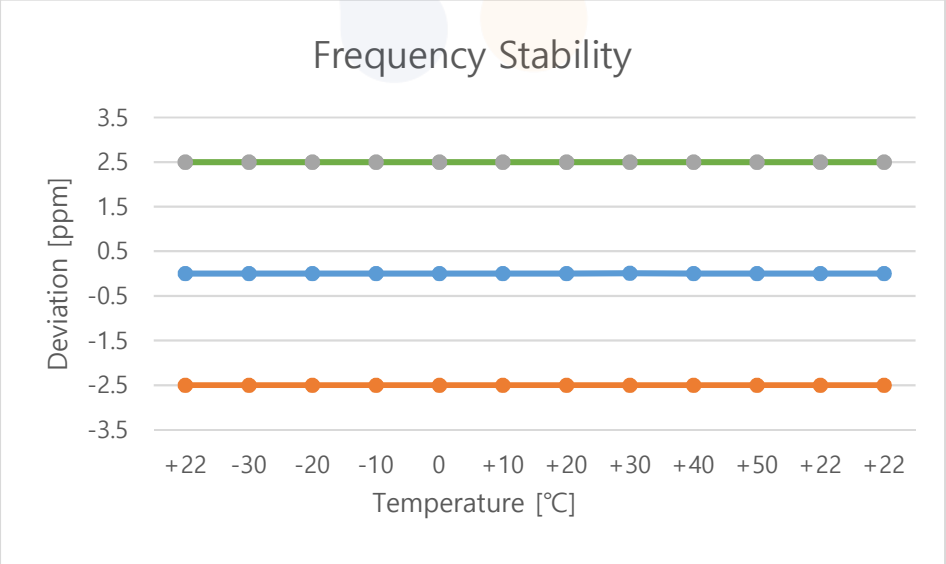
Test settings

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.

Test results

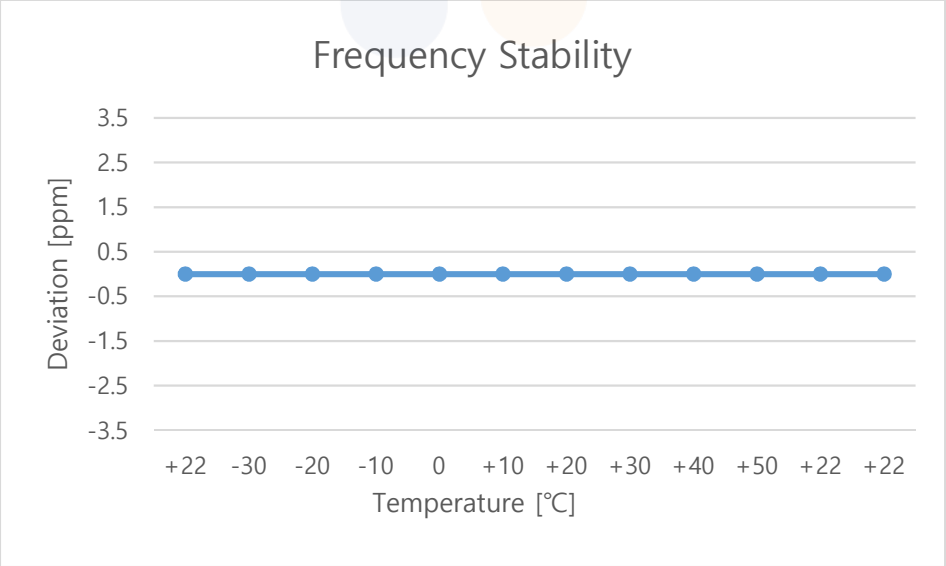
Test mode : GSM 850
Frequency (㎐) : 836 600 000
Channel : 190
Deviation limit : ±0.00025% or 2.5ppm

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	836,599,999	-0.94	0.0	0.000000
		-30	836,600,003	2.74	0.0	0.000000
		-20	836,600,001	1.08	0.0	0.000000
		-10	836,600,003	3.14	0.0	0.000000
		0	836,600,001	0.66	0.0	0.000000
		+10	836,599,999	-1.40	0.0	0.000000
		+20	836,600,002	1.61	0.0	0.000000
		+30	836,600,005	4.84	0.0	0.000001
		+40	836,600,003	2.97	0.0	0.000000
		+50	836,600,004	4.13	0.0	0.000000
115%	4.46	+22	836,600,000	-0.13	0.0	0.000000
End point	3.40	+22	836,600,000	-0.45	0.0	0.000000



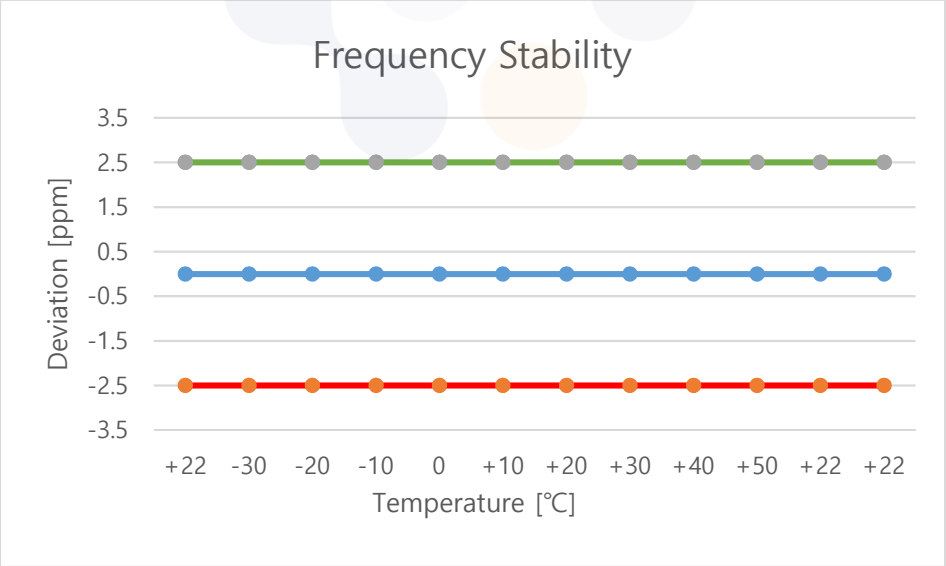
Test mode : GSM 1900
Frequency (㎐) : 1 880 000 000
Channel : 661
Deviation limit : The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	1,880,000,002	2.36	0.0	0.000000
		-30	1,879,999,998	-1.68	0.0	0.000000
		-20	1,879,999,999	-1.17	0.0	0.000000
		-10	1,879,999,998	-1.77	0.0	0.000000
		0	1,880,000,001	1.23	0.0	0.000000
		+10	1,880,000,001	1.16	0.0	0.000000
		+20	1,880,000,003	3.37	0.0	0.000000
		+30	1,880,000,006	6.03	0.0	0.000000
		+40	1,880,000,009	8.52	0.0	0.000000
		+50	1,880,000,009	9.14	0.0	0.000000
115%	4.46	+22	1,880,000,001	0.58	0.0	0.000000
End point	3.40	+22	1,880,000,001	1.10	0.0	0.000000



Test mode : WCDMA 850
Frequency (㎐) : 836 600 000
Channel : 4183
Deviation limit(FCC&IC) : ±0.00025% or 2.5 ppm

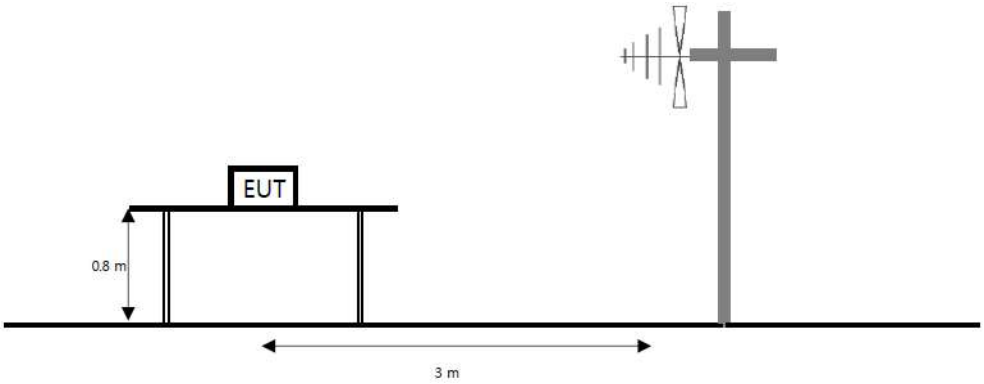
Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	836,599,997	-2.66	0.0	0.000000
		-30	836,600,001	0.84	0.0	0.000000
		-20	836,600,000	0.17	0.0	0.000000
		-10	836,600,001	0.62	0.0	0.000000
		0	836,599,999	-0.67	0.0	0.000000
		+10	836,599,999	-0.86	0.0	0.000000
		+20	836,600,000	-0.47	0.0	0.000000
		+30	836,599,999	-1.22	0.0	0.000000
		+40	836,599,998	-1.54	0.0	0.000000
		+50	836,599,998	-2.33	0.0	0.000000
115%	4.46	+22(Ref)	836,599,999	-0.61	0.0	0.000000
End point	3.40	+22(Ref)	836,599,999	-1.14	0.0	0.000000



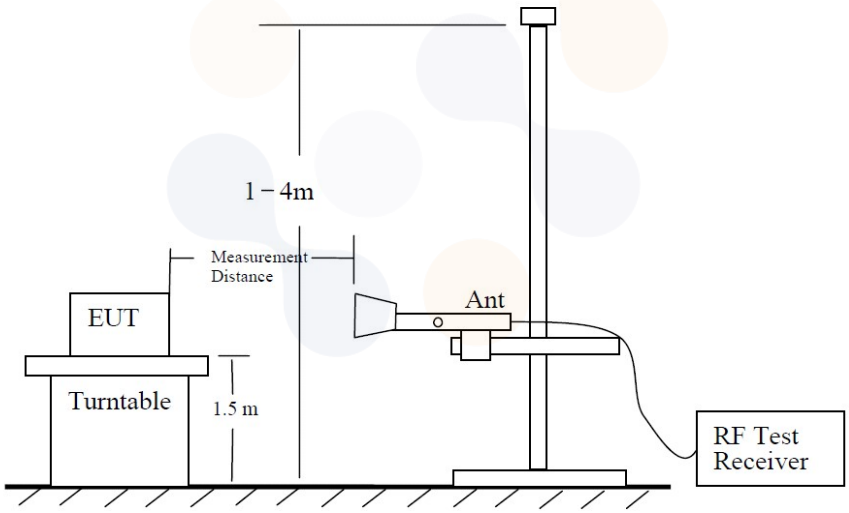
7.7. Radiated Power (ERP/EIRP)

Test setup

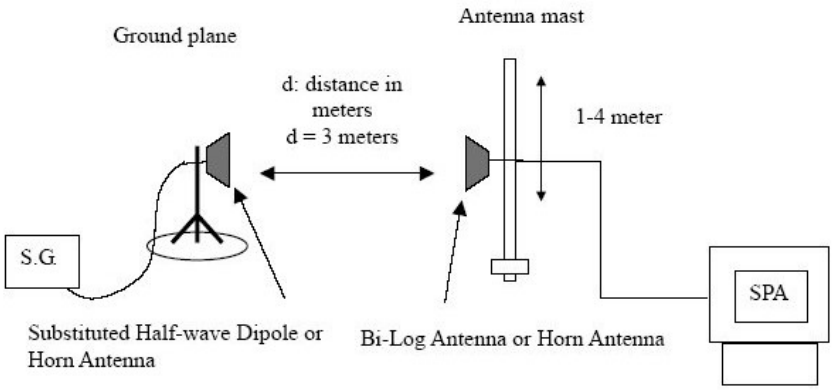
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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 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.

Test procedure

971168 D01 v03r01 - Section 5.2.2
ANSI 63.26-2015 – Section 5.2.4.4.1
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 or 1.5 m 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: GSM 850

Mode	Channel	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBd]	[dB]	[dB ㎷]	[dB ㎷]	[W]
GPRS	128	824.2	H	-2.03	5.02	35.16	28.11	0.647
	190	836.6	H	-2.44	5.13	35.64	28.07	0.641
	251	848.8	H	-2.77	5.18	35.12	27.17	0.521
EDGE	128	824.2	H	-2.03	5.02	28.97	21.92	0.156
	190	836.6	H	-2.44	5.13	29.99	22.42	0.175
	251	848.8	H	-2.77	5.18	29.57	21.62	0.145

Test mode: GSM 1900

Mode	Channel	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	EIRP	
		[㎒]	[V/H]	[dBi]	[dB]	[dB ㎷]	[dB ㎷]	[W]
GPRS	512	1 850.2	V	5.46	7.66	28.80	26.60	0.457
	661	1 880.0	V	5.39	7.76	28.37	26.00	0.398
	810	1 909.8	V	5.32	7.83	28.03	25.52	0.356
EDGE	512	1 850.2	V	5.46	7.66	25.61	23.41	0.219
	661	1 880.0	V	5.39	7.76	25.50	23.13	0.206
	810	1 909.8	V	5.32	7.83	25.34	22.83	0.192

Test mode: WCDMA 850

Mode	Channel	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBd]	[dB]	[dB ㎷]	[dB ㎷]	[W]
RMC	4132	826.40	H	-1.81	5.05	24.98	18.12	0.065
	4183	836.60	H	-2.44	5.13	25.45	17.88	0.061
	4233	846.60	H	-2.82	5.17	25.60	17.61	0.058

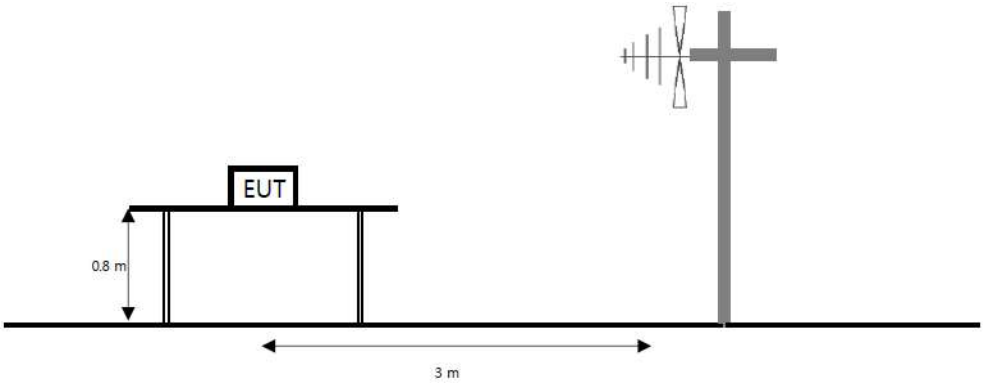
Note.

1. E.R.P & E.I.R.P(㏈m) = Substitute Level(㏈) + Antenna gain(㏈i&㏈d) - C.L(Cable loss) (㏈)

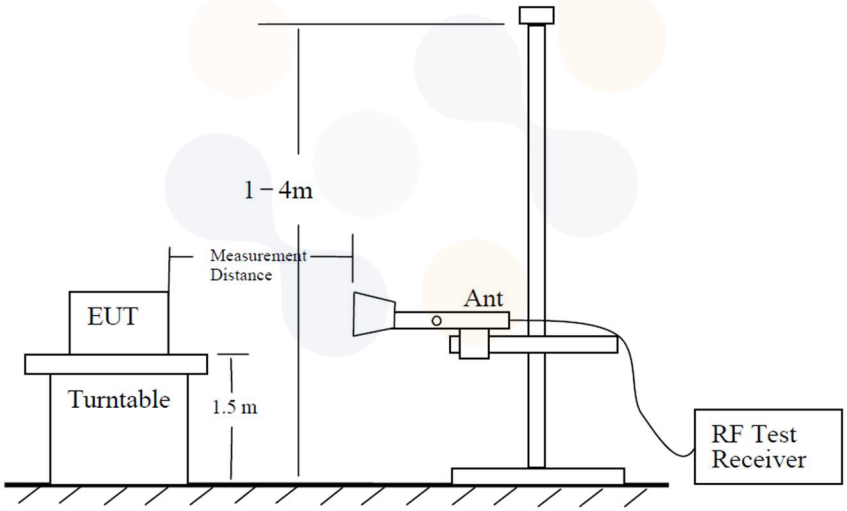
7.8. Radiated Spurious Emissions

Test setup

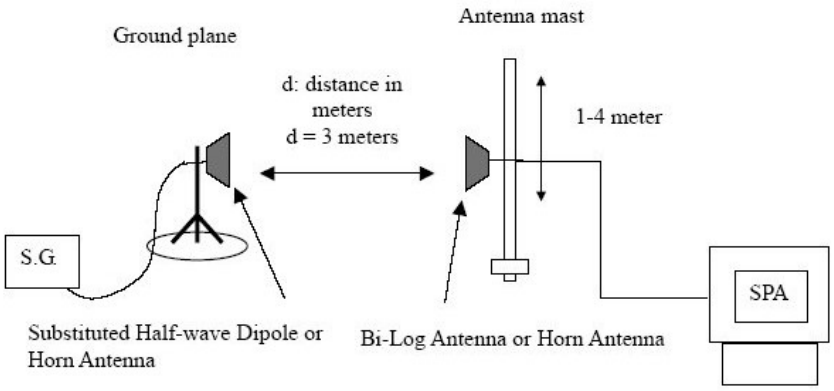
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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) ㏈.

Test procedure

971168 D01 v03r01 - Section 5.8
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 cm or 1.5 m 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 (Above 1 000 ㎒)

Test mode : GSM 850
Frequency(㎒) : 824.2
Channel : 128

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	1 650.70	H	5.94	7.18	-59.96	-61.20	-13.00	48.20
	2 472.90	V	6.14	8.89	-55.55	-58.30	-13.00	45.30
	3 300.43	H	7.74	10.55	-52.99	-55.80	-13.00	42.80
	4 122.62	V	8.83	11.94	-54.19	-57.30	-13.00	44.30

Test mode : GSM 850
Frequency(㎒) : 836.6
Channel : 190

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	1 674.50	V	5.88	7.25	-60.83	-62.20	-13.00	49.20
	2 509.82	V	6.21	8.94	-47.07	-49.80	-13.00	36.80
	3 346.38	H	7.87	10.65	-55.62	-58.40	-13.00	45.40
	4 182.52	V	8.79	11.77	-54.52	-57.50	-13.00	44.50

Test mode : GSM 850
Frequency(㎒) : 848.8
Channel : 251

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	1 699.93	V	5.82	7.31	-59.41	-60.90	-13.00	47.90
	2 546.34	V	6.26	9.01	-48.65	-51.40	-13.00	38.40
	3 396.43	V	8.01	10.75	-55.36	-58.10	-13.00	45.10
	4 245.29	V	8.75	11.88	-53.47	-56.60	-13.00	43.60

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

Test mode : GSM 1900
Frequency(㎒) : 1 850.2
Channel : 512

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	3 702.16	V	8.54	11.36	-54.98	-57.80	-13.00	44.80
	5 550.75	H	10.51	13.87	-47.94	-51.30	-13.00	38.30
	7 400.61	H	11.96	16.00	-50.16	-54.20	-13.00	41.20
	9 254.95	H	13.20	17.91	-47.59	-52.30	-13.00	39.30

Test mode : GSM 1900
Frequency(㎒) : 1 880.0
Channel : 661

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	3 760.25	H	8.61	11.26	-46.35	-49.00	-13.00	36.00
	5 640.75	V	10.53	13.84	-51.29	-54.60	-13.00	41.60
	7 523.17	H	12.12	16.18	-50.14	-54.20	-13.00	41.20
	9 401.76	H	13.20	18.04	-48.76	-53.60	-13.00	40.60

Test mode : GSM 1900
Frequency(㎒) : 1 909.8
Channel : 810

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	3 820.25	H	8.68	11.64	-55.44	-58.40	-13.00	45.40
	5 728.84	V	10.55	13.93	-46.62	-50.00	-13.00	37.00
	7 639.35	V	12.21	16.40	-50.51	-54.70	-13.00	41.70
	9 549.21	V	13.19	18.36	-47.43	-52.60	-13.00	39.60

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

Test mode : WCDMA 850
Frequency(㎒) : 826.4
Channel : 4132

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
RMC	1 651.52	V	5.94	7.18	-59.46	-60.70	-13.00	47.70
	2 479.05	V	6.15	8.91	-56.34	-59.10	-13.00	46.10
	3 305.35	V	7.75	10.56	-55.19	-58.00	-13.00	45.00
	4 132.88	H	8.82	11.96	-53.66	-56.80	-13.00	43.80

Test mode : WCDMA 850
Frequency(㎒) : 836.6
Channel : 4183

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
RMC	1 673.68	V	5.88	7.24	-59.84	-61.20	-13.00	48.20
	2 509.41	V	6.21	8.93	-54.98	-57.70	-13.00	44.70
	3 346.79	H	7.87	10.65	-53.92	-56.70	-13.00	43.70
	4 182.11	V	8.79	11.77	-52.12	-55.10	-13.00	42.10

Test mode : WCDMA 850
Frequency(㎒) : 846.6
Channel : 4233

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
RMC	1 693.78	V	5.83	7.30	-59.93	-61.40	-13.00	48.40
	2 542.64	H	6.26	9.00	-51.66	-54.40	-13.00	41.40
	3 384.94	V	7.98	10.73	-56.05	-58.80	-13.00	45.80
	4 233.81	V	8.76	11.86	-54.40	-57.50	-13.00	44.50

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

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV30	100807	22.07.27
Spectrum Analyzer	KEYSIGHT	N9040B	MY57010132	22.12.31
Vector Signal Generator	R&S	SMBV100A	257566	22.07.29
Signal Generator	R&S	SMB100A	176206	23.01.19
Power Divider	Aeroflex/ Weinschel,Inc	1580-1	NX380	22.07.29
DC Power Supply	AGILENT	E3632A	KR75304571	22.05.10
Wideband Radio Communication Tester	R&S	CMW500	141780	22.04.01
Temp & Humid Chamber	ESPEC CORP.	SH-642	93016978	23.03.04*
Biconical VHF-UHF Broadband Antenna	SCHWARZBECK	VUBA9117	275	22.04.09
Bilog Antenna	ETS.LINDGREN	3143B	00228420	23.09.28
Horn Antenna	ETS.LINDGREN	3117	161225	22.05.11
Horn Antenna	ETS.LINDGREN	3117	00227509	22.09.27
Horn Antenna	ETS.lindgren	3116	00086632	23.01.25
Horn Antenna	ETS.lindgren	3116	00086635	22.05.17
High pass Filter	Wainwright Instruments GmbH	WHKX12-2805-3000-18000-40SS	32	22.08.20
High pass Filter	Wainwright Instruments GmbH	WHKX10-900-1000-15000-40SS	11	22.08.20
Broadband Amplifier	SONOMA INSTRUMENT	315	300314	23.01.19
Amplifier	LTC MICROWAVE	LLA01185522Q-B	139	22.07.19
Amplifier	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000996	23.01.21
Antenna Stand	innco systems GmbH	AS1500-EP-10kg	N/A	N/A
Antenna Stand	innco systems GmbH	AS1500-EP-10kg	N/A	N/A
Turn Device	innco systems GmbH	DE3700-RH	N/A	N/A

* Tests related to this equipment were progressed after the calibration was completed.

End of test report