

**KCTL Inc.**

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TEL: 82-31-285-0894 FAX: 82-505-299-8311  
[www.kctl.co.kr](http://www.kctl.co.kr)

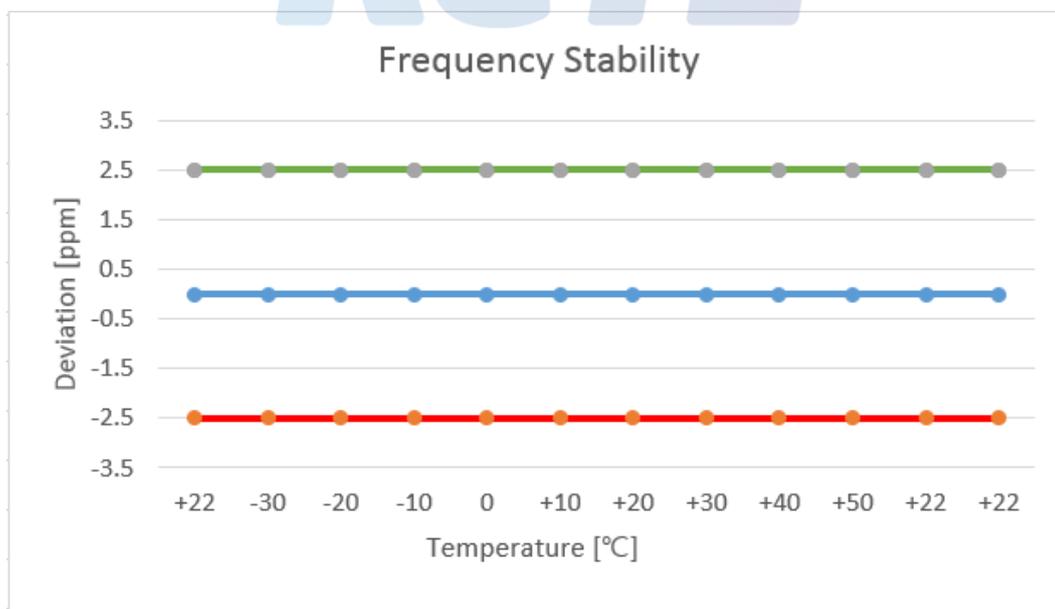
Report No.:  
KR19-SRF0122-B

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**KCTL**

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

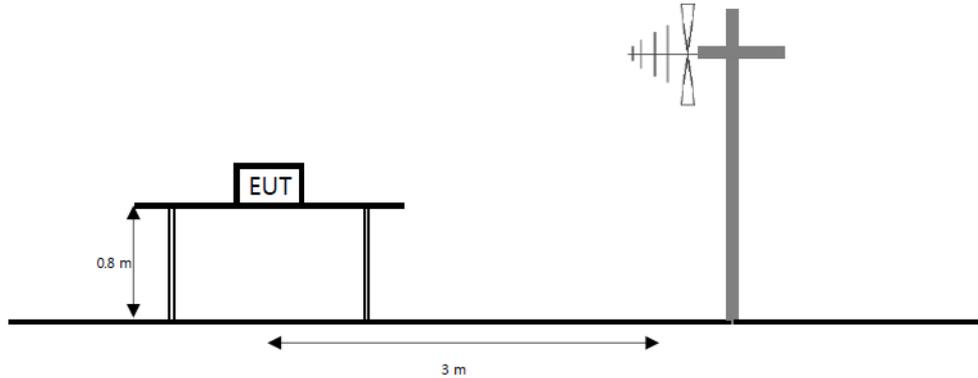
Voltage (%)	Power (V)	Temp. (°C)	Frequency (Hz)	Frequency error (Hz)	Deviation	
					(ppm)	(%)
100%	3.85	+22(Ref)	836,599,998	-1.91	0.0	0.000000
		-30	836,600,001	1.04	0.0	0.000000
		-20	836,599,999	-0.57	0.0	0.000000
		-10	836,600,002	1.71	0.0	0.000000
		0	836,599,999	-1.23	0.0	0.000000
		+10	836,600,001	0.99	0.0	0.000000
		+20	836,600,000	-0.33	0.0	0.000000
		+30	836,599,998	-1.73	0.0	0.000000
		+40	836,599,997	-2.56	0.0	0.000000
		+50	836,599,998	-2.26	0.0	0.000000
115%	4.43	+22	836,599,998	-2.39	0.0	0.000000
End point	2.55	+22	836,599,996	-3.73	0.0	0.000000



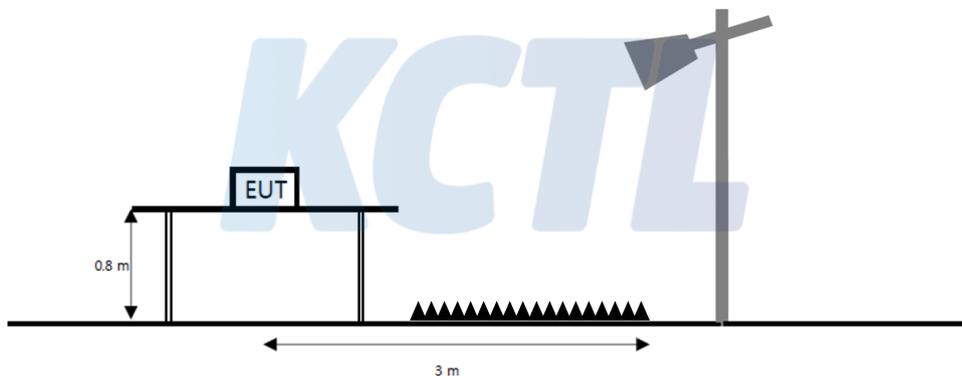
## 7.7. Radiated Power (ERP/EIRP)

### Test setup

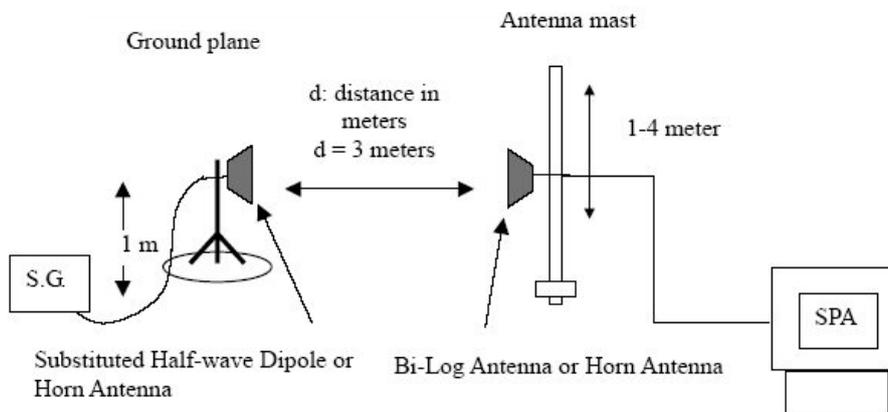
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz 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. And according to RSS-132(5.4), the equivalent isotropically radiated power (e.i.r.p) for mobile equipment shall not exceed 11.5 watts. Refer to SRSP-503 for base stations e.i.r.p limits.

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  $\geq 3 \times$  RBW.
- 3) SPAN = 2  $\times$  to 3  $\times$  the OBW.
- 4) Number of measurement points in sweep  $\geq 2 \times$  span / RBW.
- 5) Sweep time :
  - 1) Auto couple, or
  - 2)  $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$  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 GHz below) or horn antenna (1 GHz above) connected to a signal generator.  
The power is calculated by the following formula;  
$$Pd(\text{dBm}) = Pg(\text{dBm}) - \text{Cable loss (dB)} + \text{Antenna gain (dB)}$$
  
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 dBm, 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.

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**Test results****Test mode: GSM 850**

Mode	Channel	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[MHz]	[V/H]	[dBi]	[dB]	[dB m]	[dB m]	[W]
GPRS	128	824.2	H	-0.60	3.69	33.73	29.44	0.879
	190	836.6	H	-0.50	3.71	33.82	29.61	0.914
	251	848.8	V	-0.50	3.74	34.56	30.32	1.076
EDGE	128	824.2	H	-0.60	3.69	31.90	27.61	0.577
	190	836.6	H	-0.50	3.71	31.90	27.69	0.587
	251	848.8	V	-0.50	3.74	32.76	28.52	0.711

**Test mode: GSM 1900**

Mode	Channel	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	EIRP	
		[MHz]	[V/H]	[dBi]	[dB]	[dB m]	[dB m]	[W]
GPRS	512	1 850.2	V	4.60	5.73	23.53	22.40	0.174
	661	1 880.0	V	4.90	5.78	27.61	26.73	0.471
	810	1 909.8	V	4.90	5.80	29.05	28.15	0.653
EDGE	512	1 850.2	V	4.60	5.73	21.85	20.72	0.118
	661	1 880.0	V	4.90	5.78	25.67	24.79	0.301
	810	1 909.8	V	4.90	5.80	27.22	26.32	0.429

**Test mode: WCDMA 850**

Mode	Channel	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[MHz]	[V/H]	[dBi]	[dB]	[dB m]	[dB m]	[W]
RMC	4132	826.4	H	-0.60	3.70	25.24	20.94	0.124
	4183	836.6	H	-0.50	3.71	24.65	20.44	0.111
	4233	846.6	H	-0.50	3.74	25.21	20.97	0.125
HSUPA	4132	826.4	H	-0.60	3.70	23.87	19.57	0.091
	4183	836.6	H	-0.50	3.71	23.05	18.84	0.077
	4233	846.6	H	-0.50	3.74	23.28	19.04	0.080

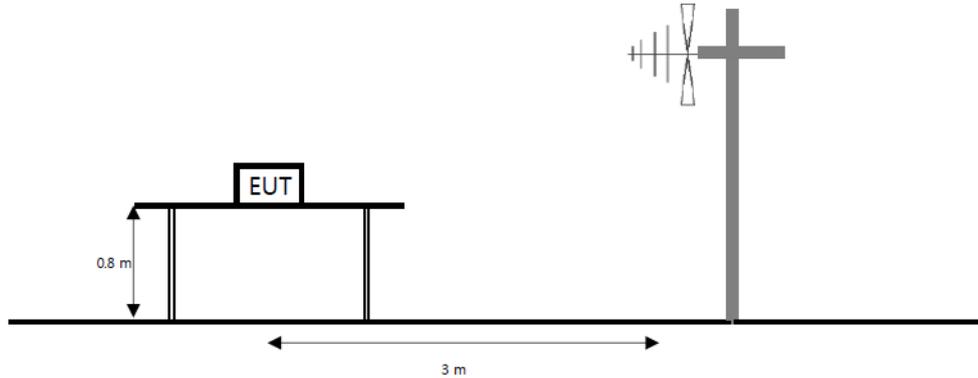
Note.

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

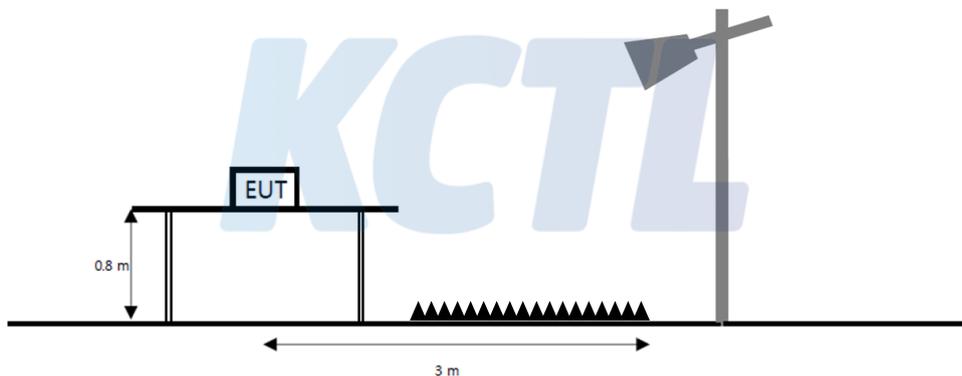
## 7.8. Radiated Spurious Emissions

### Test setup

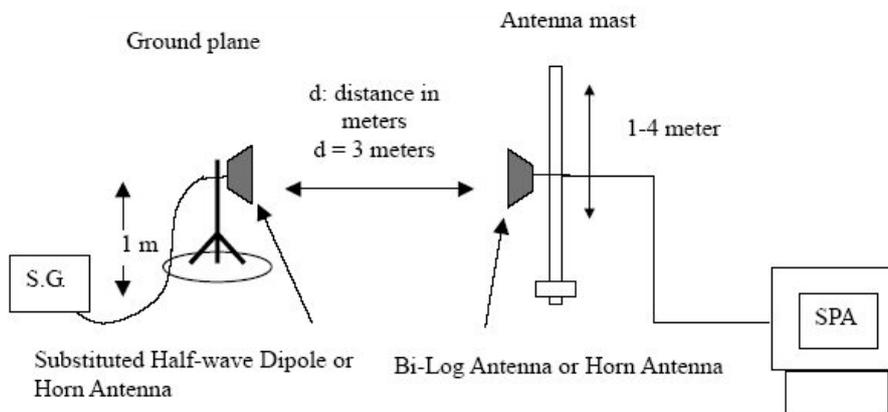
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



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



The diagram below shows the test setup for substituted method.



**Limit**

According to §22.917(a), §24.238(a) and RSS-132(5.5), RSS-133(6.5), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10\log(P)$  dB.

According to §27.53(h) and RSS-139(6.6), the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10\log(P_{\text{Watts}})$  dB.

**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**

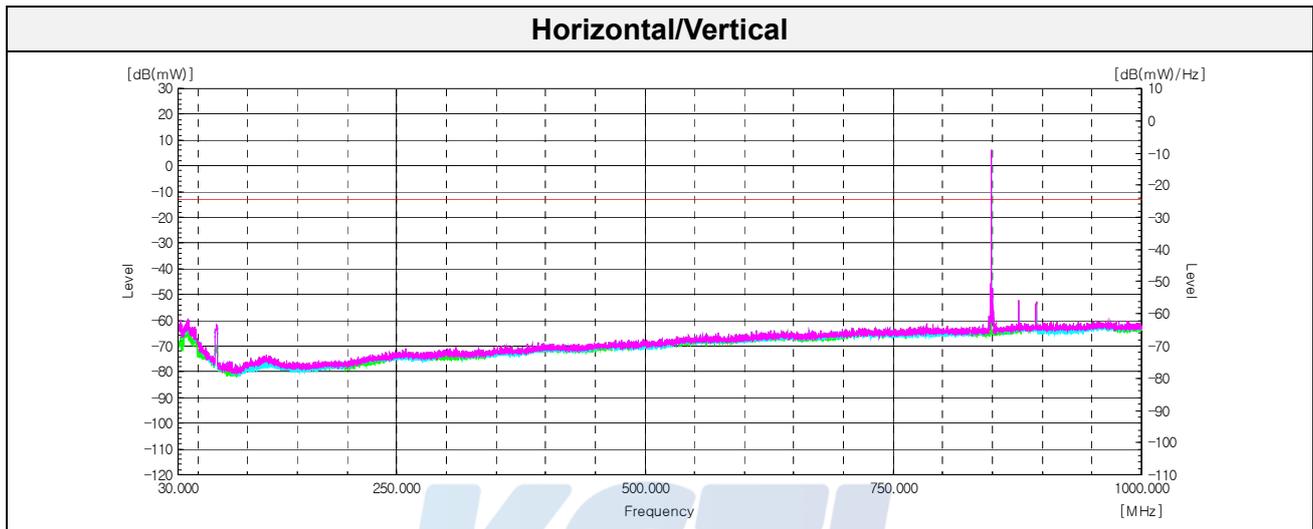
- 1) RBW = 1 kHz for below 1 GHz and 1 MHz for above 1 GHz.
- 2) VBW  $\geq 3 \times$  RBW.
- 3) Detector = RMS
- 4) Trace mode = Max hold
- 5) Sweep time = Auto couple
- 6) Number of sweep points  $\geq 2 \times$  span / RBW
- 7) Allow trace to fully stabilize.

**Notes:**

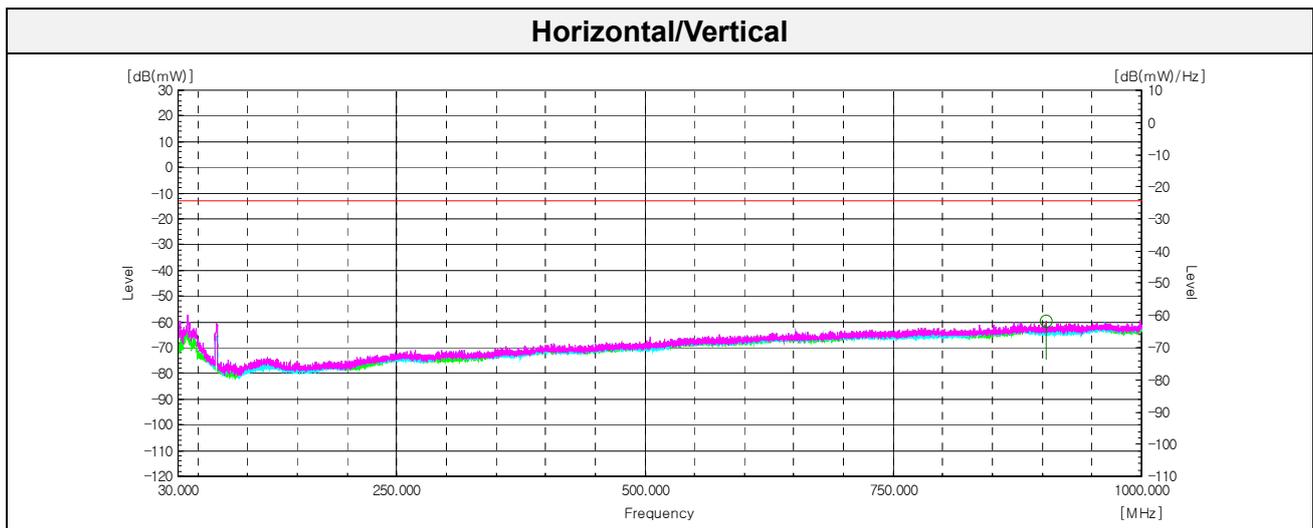
1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
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 GHz below) or horn antenna (1 GHz 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 dBm, 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.
11. This EUT was tested under all configurations and the highest power is reported in RMC mode

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

Test mode : GSM 850  
Frequency (MHz) : 848.80  
Channel : 251



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

**Note.**

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

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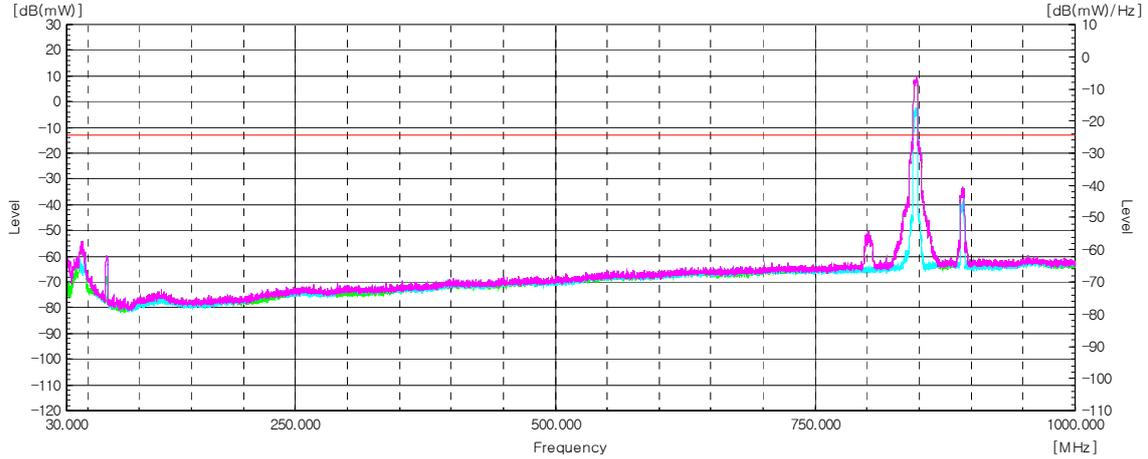
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Test mode : WCDMA 850  
Frequency (MHz) : 846.60  
Channel : 4233

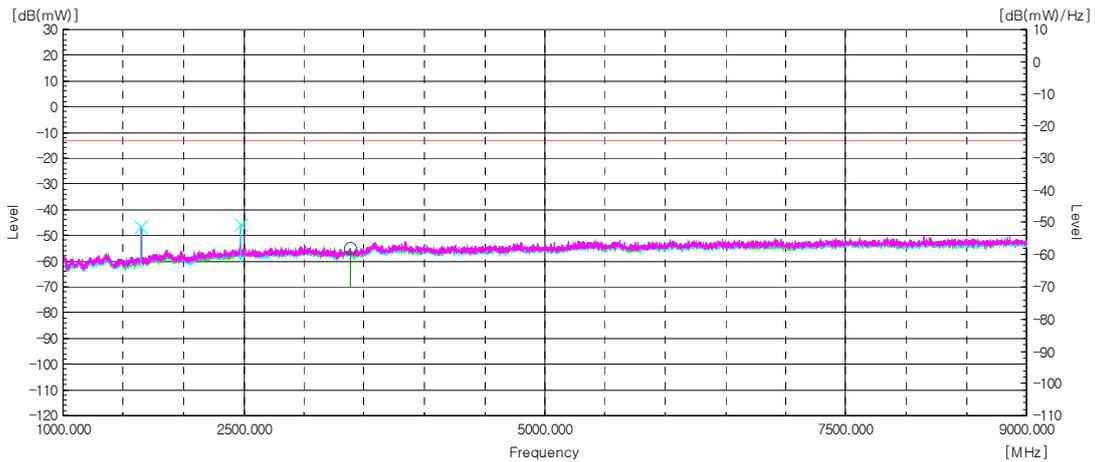
## Horizontal/Vertical



### Note.

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

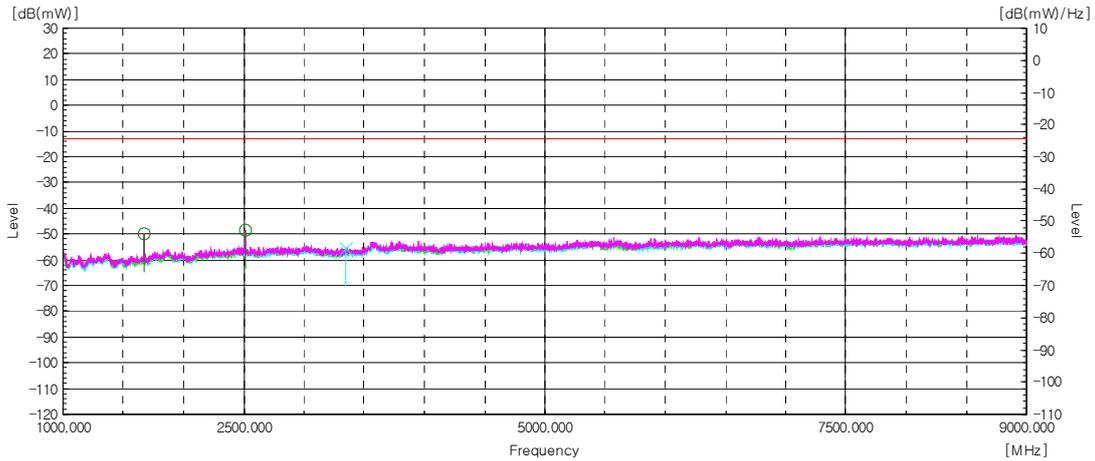
# KCTL

**Test results (Above 1 000 MHz)**Test mode : GSM 850Frequency(MHz) : 824.2Channel : 128**Horizontal/Vertical**

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	1 648.081	V	5.90	5.33	-47.37	-46.80	-13.00	33.80
	2 472.184	V	6.20	6.59	-45.51	-45.90	-13.00	32.90
	3 383.298	H	7.60	7.56	-54.94	-54.90	-13.00	41.90

## Note.

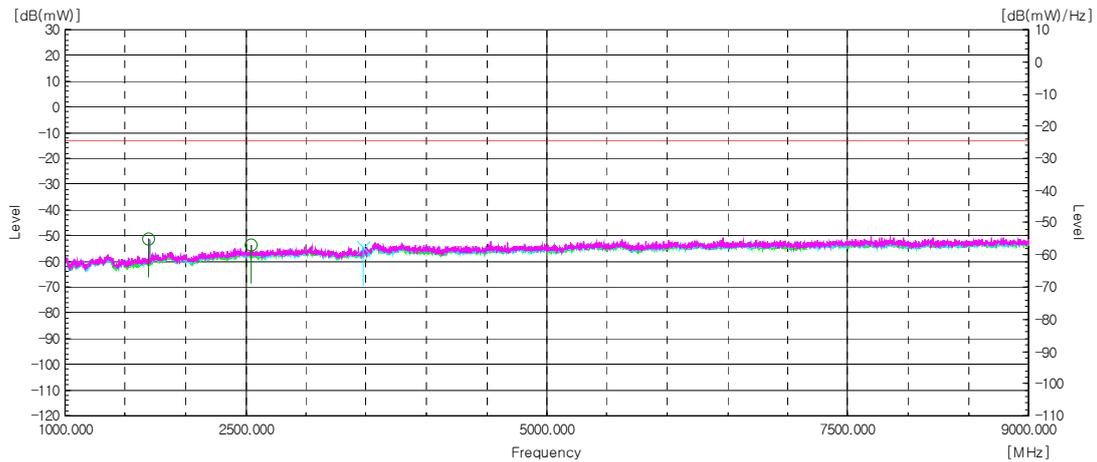
1. Limit Calculation(dBm)= 43 + 10log(P<sub>[Watts]</sub>)
2. Level(dBm) = Antenna gain(dBi) - Cable loss(dB) - Substitute level(dBm)

Test mode : GSM 850Frequency(MHz) : 836.6Channel : 190**Horizontal/Vertical**

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	1 673.084	H	5.10	5.38	-49.62	-49.90	-13.00	36.90
	2 510.189	H	6.30	6.62	-48.38	-48.70	-13.00	35.70
	3 346.293	V	7.70	7.63	-55.57	-55.50	-13.00	42.50

Note.

1. Limit Calculation(dBm)= 43 + 10log(P<sub>Watts</sub>)
2. Level(dB m) = Antenna gain(dB i) - Cable loss(dB) - Substitute level(dB m)

Test mode : GSM 850Frequency(MHz) : 848.8Channel : 251**Horizontal/Vertical**

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	1 697.087	H	4.60	5.44	-50.66	-51.50	-13.00	38.50
	2 546.193	H	6.40	6.73	-53.37	-53.70	-13.00	40.70
	3 476.309	V	7.90	7.69	-54.71	-54.50	-13.00	41.50

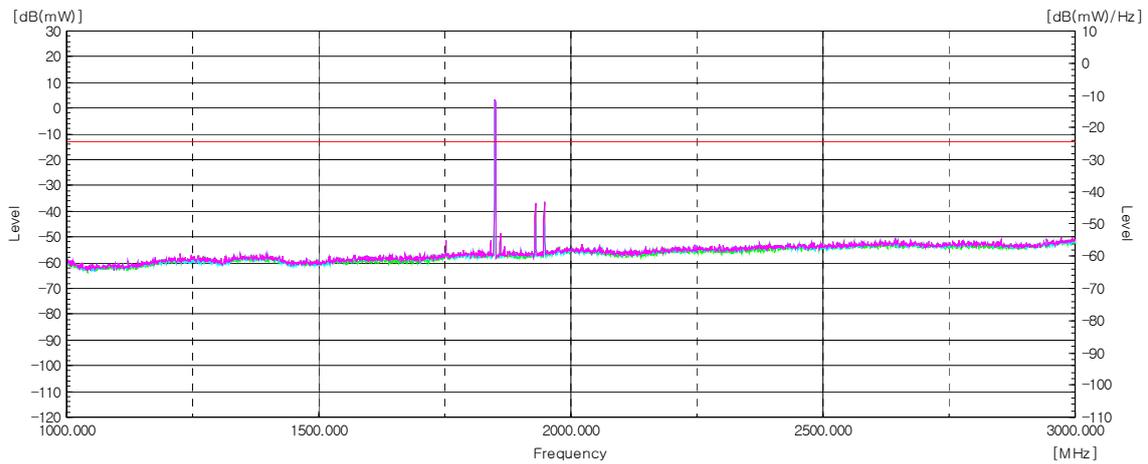
Note.

1. Limit Calculation(dBm)= 43 + 10log(P<sub>Watts</sub>)

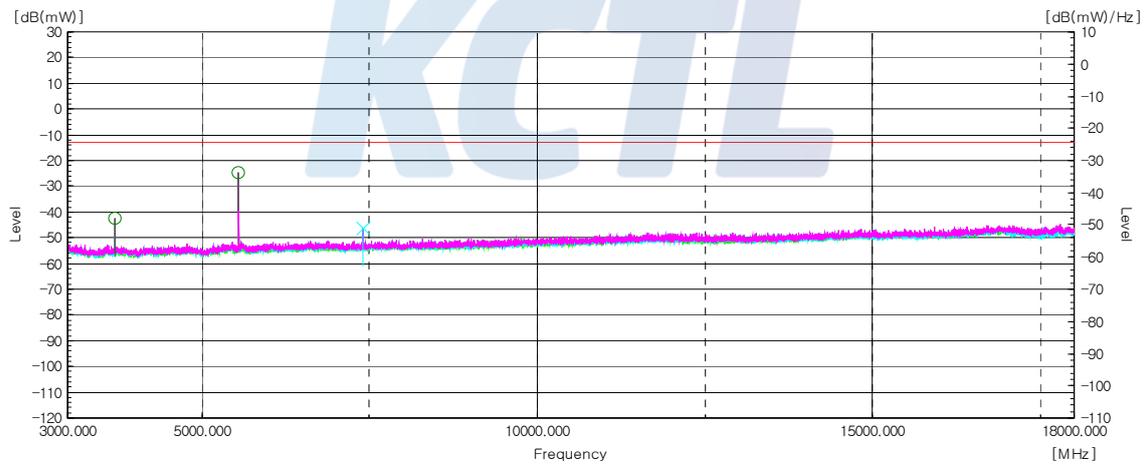
2. Level(dB m) = Antenna gain(dB i) - Cable loss(dB) - Substitute level(dB m)

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

**Horizontal/Vertical for 1 GHz ~ 3 GHz**



**Horizontal/Vertical for 3 GHz ~ 18 GHz**



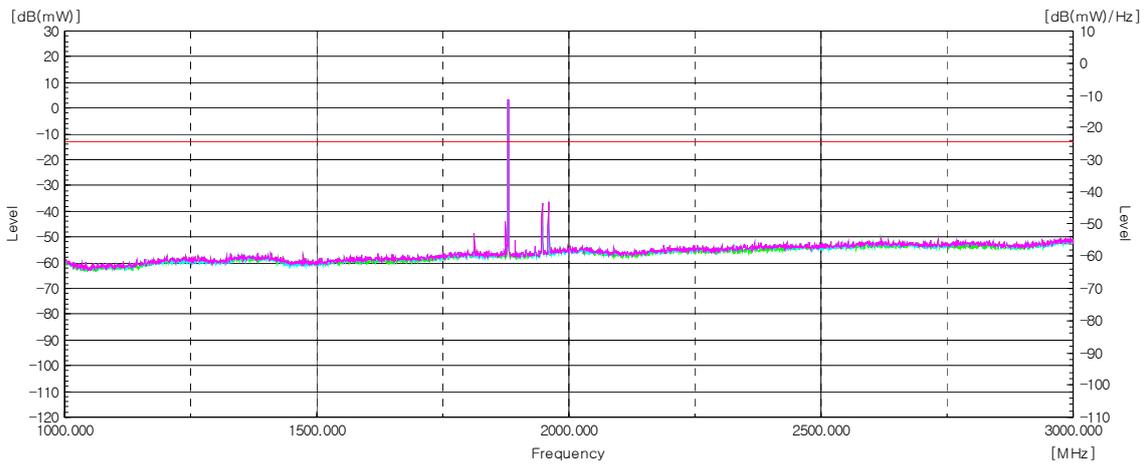
Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	3 700.047	H	7.90	8.15	-42.05	-42.30	-13.00	29.30
	5 551.170	H	10.30	10.08	-24.82	-24.60	-13.00	11.60
	7 400.293	V	11.80	11.62	-46.38	-46.20	-13.00	33.20

Note.

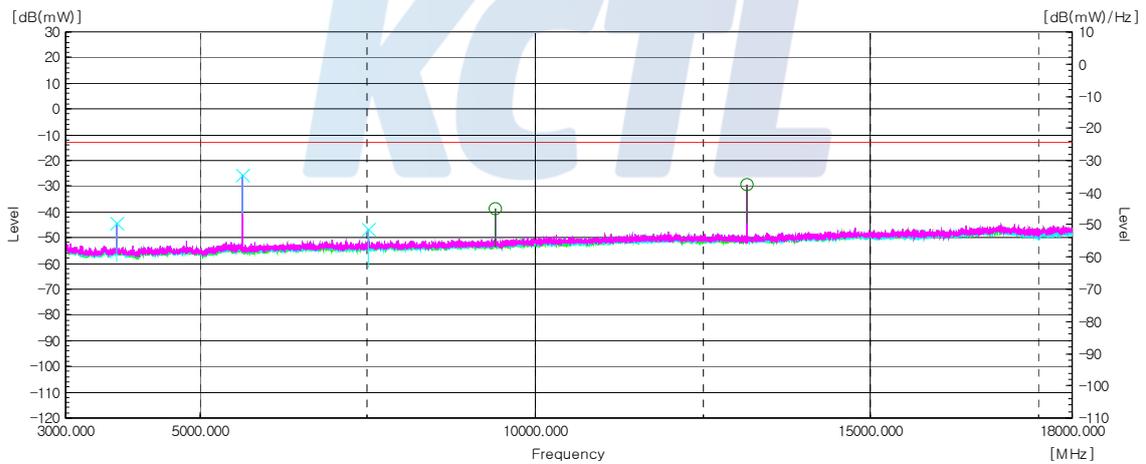
1. Limit Calculation(dBm)= 43 + 10log(P<sub>Watts</sub>)
2. Level(dB m) = Antenna gain(dB i) - Cable loss(dB) - Substitute level(dB m)

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

**Horizontal/Vertical for 1 GHz ~ 3 GHz**



**Horizontal/Vertical for 3 GHz ~ 18 GHz**



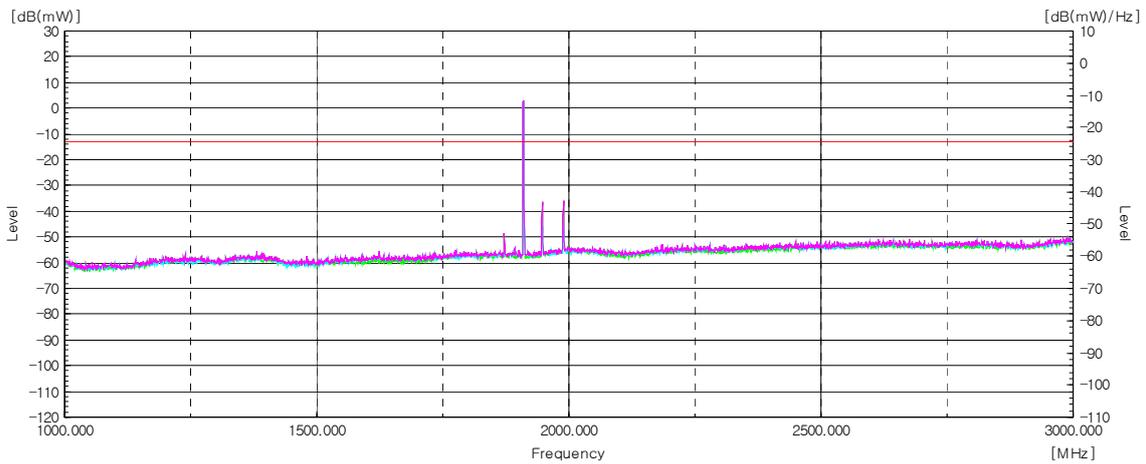
Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	5 640.176	V	10.40	10.29	-25.61	-25.50	-13.00	12.50
	9 400.426	H	13.00	13.31	-38.49	-38.80	-13.00	25.80
	13 160.676	H	13.70	15.78	-27.42	-29.50	-13.00	16.50

Note.

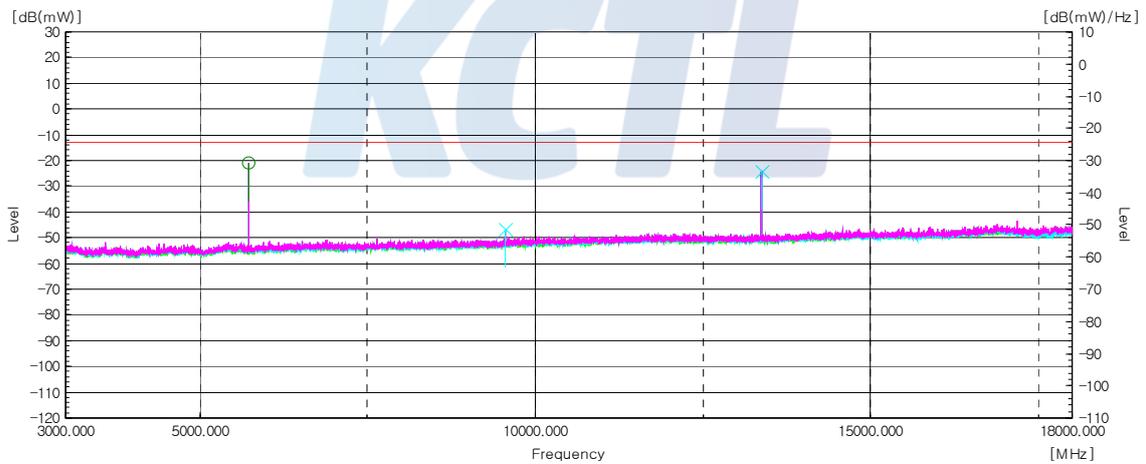
1. Limit Calculation(dBm)= 43 + 10log(P<sub>Watts</sub>)
2. Level(dB m) = Antenna gain(dB i) - Cable loss(dB) - Substitute level(dB m)

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

**Horizontal/Vertical for 1 GHz ~ 3 GHz**



**Horizontal/Vertical for 3 GHz ~ 18 GHz**



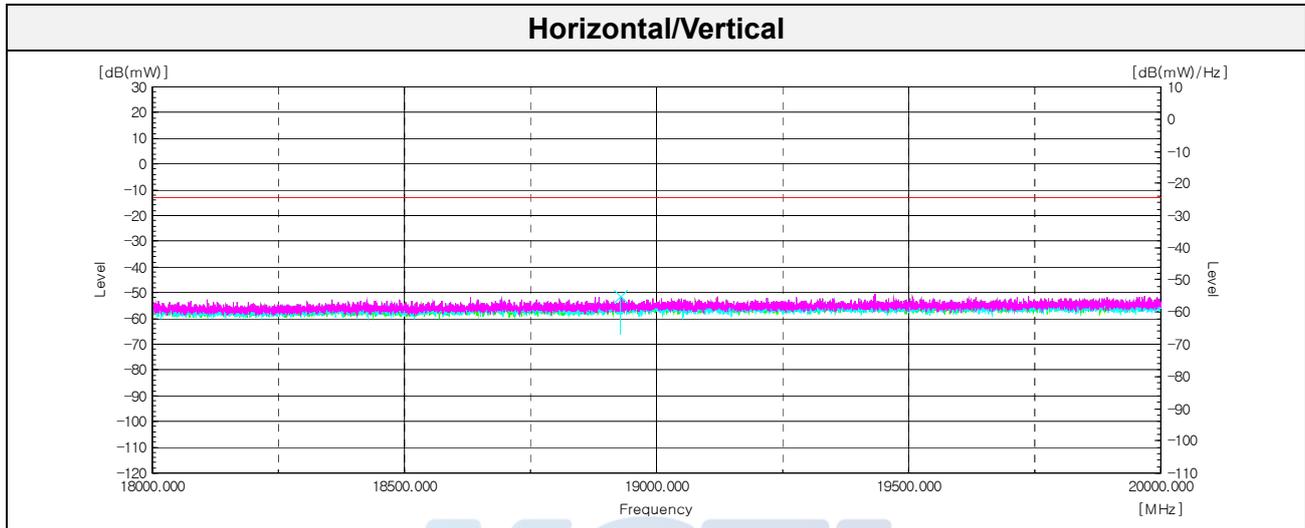
Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
GPRS	5 729.182	H	10.40	10.38	-20.82	-20.80	-13.00	7.80
	9 549.436	V	12.90	13.28	-46.12	-46.50	-13.00	33.50
	13 368.690	V	13.50	15.86	-21.94	-24.30	-13.00	11.30

Note.

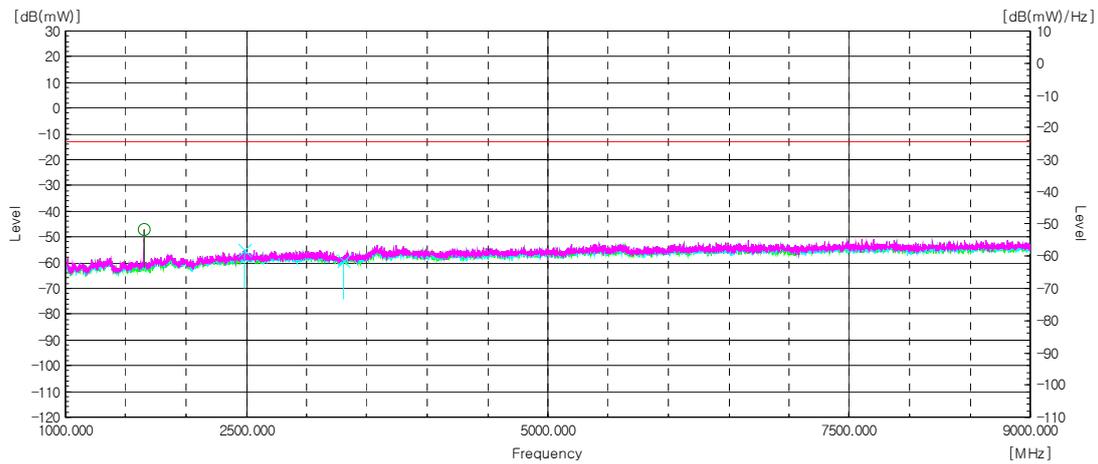
1. Limit Calculation(dBm)= 43 + 10log(P<sub>Watts</sub>)
2. Level(dB m) = Antenna gain(dB i) - Cable loss(dB) - Substitute level(dB m)

**Test results (Above 18 GHz to 20 GHz) – Worst case**

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

**Note.**

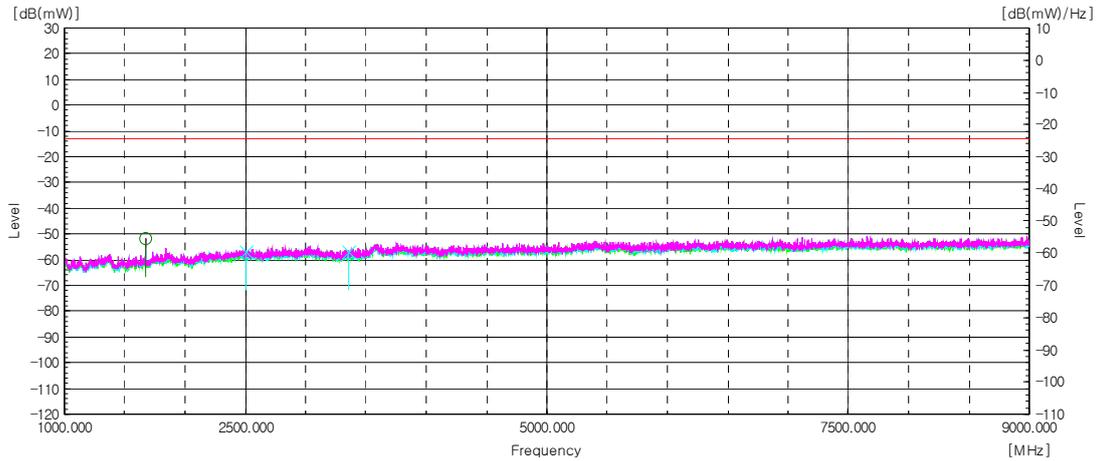
1. No spurious emissions were detected above 18GHz.

Test mode : WCDMA 850Frequency(MHz) : 826.4Channel : 4132**Horizontal/Vertical**

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
RMC	1 651.081	H	5.60	5.35	-47.55	-47.30	-13.00	34.30
	2 482.185	V	6.20	6.59	-54.71	-55.10	-13.00	42.10
	3 302.288	V	7.70	7.63	-59.27	-59.20	-13.00	46.20

Note.

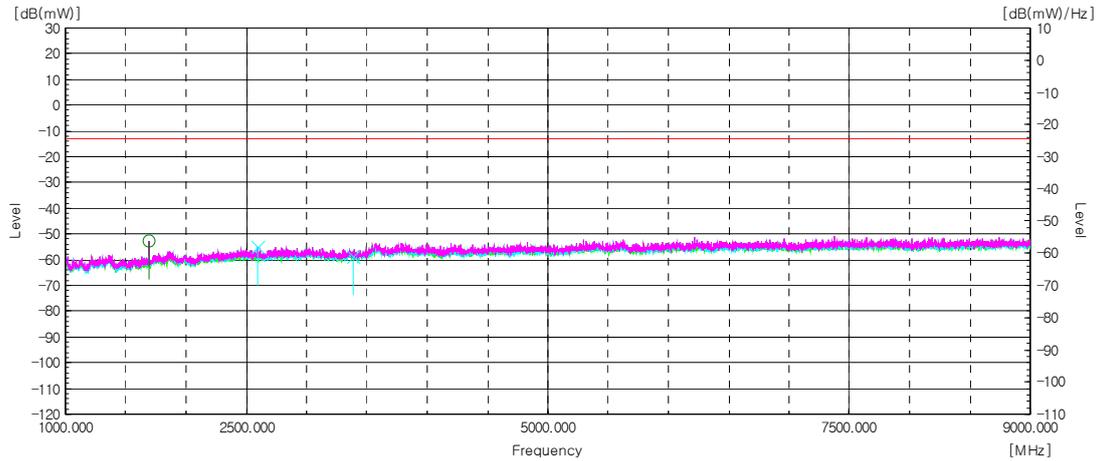
1. Limit Calculation(dBm)= 43 + 10log(P<sub>Watts</sub>)
2. Level(dB m) = Antenna gain(dB i) - Cable loss(dB) - Substitute level(dB m)

Test mode : WCDMA 850Frequency(MHz) : 836.6Channel : 4183**Horizontal/Vertical**

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
RMC	1 676.085	H	5.10	5.41	-51.49	-51.80	-13.00	38.80
	2 501.188	V	6.30	6.62	-56.48	-56.80	-13.00	43.80
	3 360.295	V	8.10	7.69	-57.51	-57.10	-13.00	44.10

Note.

1. Limit Calculation(dBm)= 43 + 10log(P<sub>Watts</sub>)
2. Level(dB m) = Antenna gain(dB i) - Cable loss(dB) - Substitute level(dB m)

Test mode : WCDMA 850Frequency(MHz) : 848.6Channel : 4233**Horizontal/Vertical**

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
RMC	1 694.087	H	4.60	5.44	-51.86	-52.70	-13.00	39.70
	2 592.199	V	6.40	6.78	-54.62	-55.00	-13.00	42.00
	3 385.298	V	7.90	7.69	-58.81	-58.60	-13.00	45.60

Note.

- Limit Calculation(dBm)= 43 + 10log(P<sub>Watts</sub>)
- Level(dBm) = Antenna gain(dBi) - Cable loss(dB) - Substitute level(dBm)

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## 8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R & S	FSV30	100808	20.07.30
Spectrum Analyzer	AGILENT	N9040B	MY57010132	19.10.12
Signal Generator	R&S	SMR40	100007	20.05.13
Power Divider	AGILENT	11636B	54456	20.01.08
Attenuator	API Inmet	40AH2W-10	14	20.05.15
Attenuator	Weinschel ENGINEERING	10	AJ1239	20.05.14
DC Power Supply	Agilent	E3632A	KR94907664	20.05.13
Temp & Humid Chamber	ESPEC CORP.	SH-661	92004048	20.01.04
Wideband Radio Communication Tester	R & S	CMW500	132120	20.07.17
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
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	3117	161225	20.05.22
Horn Antenna	ETS.lindgren	3115	62589	20.08.01
Horn Antenna	ETS.lindgren	3116	00086632	20.02.15
Horn Antenna	ETS.lindgren	3116	00086635	20.05.09
Amplifier	SONOMA INSTRUMENT	317	321041	20.01.04
Amplifier	L-3 Narda-MITE	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
Cable Assembly	Radiall	R286303620	1649.241	N/A
Cable Assembly	Radiall	TESTPRO 3	N/A	N/A
Cable Assembly	JUNFLON	J12J102248-00-5	JUL-06-14-108	N/A
Cable Assembly	JUNFLON	MWX221-DMWDMS	J0965546	N/A

**End of test report**