



TEST REPORT

KCTL KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0269-A

Page (1) of (16)

KCTL

1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2020-09-28

2. Use of Report : Class II Permissive change

3. Name of Product / Model : Mobile phone / SM-F415F/DS

4. Manufacturer / Country of Origin : Samsung Electronics Co., Ltd. / Vietnam

5. FCC ID : A3LSMM315F

6. Date of Test : 2020-10-06 to 2020-10-15

7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing (Address: Address of testing location)

8. Test method used : FCC Part 2
FCC Part 90 subpart S

9. Test Results : Refer to the test result in the test report

Affirmation	Tested by	Technical Manager
	Name : Kwonsu Kim (Signature)	Name : Seungyong Kim (Signature)

2020-10-19

KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2020-10-16	Originally issued	-
2020-10-19	Updated	3, 7

This report shall not be reproduced except in full, without the written approval of KCTL Inc. This document may be altered or revised by KCTL Inc. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by KCTL Inc. will constitute fraud and shall nullify the document. This test report is a general report that does not use the KOLAS accreditation mark and is not related to KS Q ISO/IEC 17025 and KOLAS accreditation.

Note. The report No. KR20-SRF0269 is superseded by the report No. KR20-SRF0269-A.

General remarks for test reports

Nothing significant to report.



CONTENTS

1.	General information	4
2.	Device information	4
2.1.	Accessory information	6
2.2.	Frequency/channel operations	6
3.	Summary of tests	7
3.1.	Worst case orientation	7
4.	Measurement uncertainty	7
5.	Test results	8
5.1.	Radiated Power (ERP/EIRP)	8
5.2.	Radiated Spurious Emissions	12
6.	Measurement equipment	16

KCTL

1. General information

Client : Samsung Electronics Co., Ltd.
 Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
 Manufacturer : Samsung Electronics Co., Ltd.
 Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
 Factory : Samsung Electronics Vietnam Thai Nguyen Co., Ltd
 Address : 506-723 16000 Yen Phong 1 Industrial Zone, Yen Trung Commu, Yen Phong District, Bac Ninh Province, Vietnam
 Factory : Samsung India Electronics PVT. Ltd
 Address : B-1, Sector-8 NOIDA Uttar Pradesh, India 201-305
 Factory : Samsung Electronics Co., Ltd.
 Address : 94-1, Imsu-dong, Gumi-si, Gyeongsangbuk-ro, 730-722, Republic of Korea
 Laboratory : KCTL Inc.
 Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
 Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132
 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056
 Industry Canada Registration No. : 8035A
 KOLAS No.: KT231

2. Device information

Equipment under test : Mobile phone
 Model : SM-F415F/DS
 Modulation technique : Bluetooth(BDR/EDR)_GFSK, $\pi/4$ DQPSK, 8DPSK
 Bluetooth(BLE)_GFSK
 WIFI(802.11b/g/n20/n40/ac20/ac40/ac80)_DSSS, OFDM
 LTE_QPSK, 16QAM
 WCDMA_QPSK
 GSM_GMSK, 8-PSK
 Number of channels : Bluetooth(BDR/EDR)_79 ch / Bluetooth(BLE)_40 ch
 WIFI(802.11b/g/n20)_11 ch
 UNII-1 : 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
 UNII-2A : 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
 UNII-2C : 12 ch (20 MHz), 6 ch (40 MHz), 3 ch (80 MHz)
 UNII-3 : 5 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
 Power source : DC 3.85 V
 Antenna specification : LTE/GSM/WCDMA_LDS Antenna
 WIFI/Bluetooth(BDR/EDR/BLE)_LDS Antenna

Antenna gain : WIFI/Bluetooth(BDR/EDR/BLE) : -3.4 dBi
UNII-1 -5.9 dBi
UNII-2A -6.3 dBi
UNII-2C -5.3 dBi
UNII-3 -6.6 dBi

Frequency range : Bluetooth(BDR/EDR/BLE)_2 402 MHz ~ 2 480 MHz
2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20)
UNII-1: 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20/ac_VHT20)
UNII-1: 5 190 MHz ~ 5 230 MHz (802.11n_HT40/ac_VHT40)
UNII-1: 5 210 MHz (802.11ac_VHT80)
UNII-2A: 5 260 MHz ~ 5 320 MHz (802.11a/n_HT20/ac_VHT20)
UNII-2A: 5 270 MHz ~ 5 310 MHz (802.11n_HT40/ac_VHT40)
UNII-2A: 5 290 MHz (802.11ac_VHT80)
UNII-2C: 5 500 MHz ~ 5 720 MHz (802.11a/n_HT20/ac_VHT20)
UNII-2C: 5 510 MHz ~ 5 710 MHz (802.11n_HT40/ac_VHT40)
UNII-2C: 5 530 MHz ~ 5 690 MHz (802.11ac_VHT80)
UNII-3: 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20/ac_VHT20)
UNII-3: 5 755 MHz ~ 5 795 MHz (802.11n_HT40/ac_VHT40)
UNII-3: 5 775 MHz (802.11ac_VHT80)
LTE Band 2_1 850.7 MHz ~ 1 909.3 MHz
LTE Band 4_1 710.7 MHz ~ 1 754.3 MHz
LTE Band 5_824.7 MHz ~ 848.3 MHz
LTE Band 12_699.7 MHz ~ 715.3 MHz
LTE Band 13_779.5 MHz ~ 784.5 MHz
LTE Band 17_706.5 MHz ~ 713.5 MHz
LTE Band 26_824.7 MHz ~ 848.3 MHz, 814.7 MHz ~ 823.3 MHz
LTE Band 41_2 498.5 MHz ~ 2 687.5 MHz
LTE Band 66_1 710.7 MHz ~ 1 779.3 MHz
GSM 850_824.2 MHz ~ 848.8 MHz
GSM 1900_1 850.2 MHz ~ 1 909.8 MHz
WCDMA 850_826.4 MHz ~ 846.6 MHz
WCDMA 1700_1 712.4 MHz ~ 1 752.6 MHz
WCDMA 1900_1 852.4 MHz ~ 1 907.6 MHz

Software version : M315F.001
Hardware version : REV1.0
Test device serial No. : Conducted(RZ8N122TM7N), Radiated(R38N8004GLE)
Operation temperature : -30 °C ~ 50 °C

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Travel Adapter	Samsung Electronics Co., Ltd.	EP-TA200	R37M4NR27T1SE3	AC 100-240V 50-60 Hz, 0.5A, 9.0V-1.67A, 5.0V-2.0A
Micro USB Data Cable	Samsung Electronics Co., Ltd.	-	-	-

2.2. Frequency/channel operations

This device contains the following capabilities:

WIFI (802.11a/b/g/n/ac), Bluetooth (BDR/EDR/BLE),

LTE Band 2, LTE Band 4, LTE Band 5, LTE Band 12, LTE Band 13, LTE Band 17, LTE Band 26,
 LTE Band 41, LTE Band 66, WCDMA 850, WCDMA 1700, WCDMA 1900, GSM 850, GSM 1900

LTE Band 26

Ch.	Frequency (MHz)
26697	814.7
26783	823.3
26790	824.0

Table 2.2.1. 1.4M BW

Ch.	Frequency (MHz)
26705	815.5
26775	822.5
26790	824.0

Table 2.2.2. 3M BW

Ch.	Frequency (MHz)
26715	816.5
26765	821.5
26790	824.0

Table 2.2.3. 5M BW

Ch.	Frequency (MHz)
26740	819.0
26790	824.0

Table 2.2.4. 10M BW

Ch.	Frequency (MHz)
26765	821.5
26790	824.0

Table 2.2.5. 15M BW

3. Summary of tests

FCC Part section(s)	Parameter	Test Limit	Test Condition	Test results
22.913(a)(5)	Effective Radiated Power	< 7 Watts max. ERP	Radiated	Pass
2.1053 90.691(a)	Radiated Spurious Emissions	<43 + 10Log ₁₀ (P) dB		Pass

Notes:

- The test procedure(s) in this report were performed in accordance as following.
 - ANSI C63.26-2015
 - ANSI/TIA-603-E-2016
 - KDB 971168 D01 v03r01
- This is the C2PC test report to add a variant model, SM-F415F/DS as documented in the C2PC letter. Because the change does not affect RF characteristics, therefore, only radiated spurious emission test was done against the worst case from the main model, SM-M315F/DS, documented in the original filing and approved in 02/07/2020. All rest tests documented in original filing under model SM-M315F/DS remains representative of the variant model, SM-F415F/DS.

3.1. Worst case orientation

- All modes of operation were investigated and the worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations in the test data.
- All final radiated testing was performed with the EUT in worst case orientation.
- The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **Z** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **Z** orientation.

Test condition	LTE Band	Modulation	Bandwidth (MHz)	RB size	RB offset
Radiated	B26 (Part90)	QPSK	3	1	0

4. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014.

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicated a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

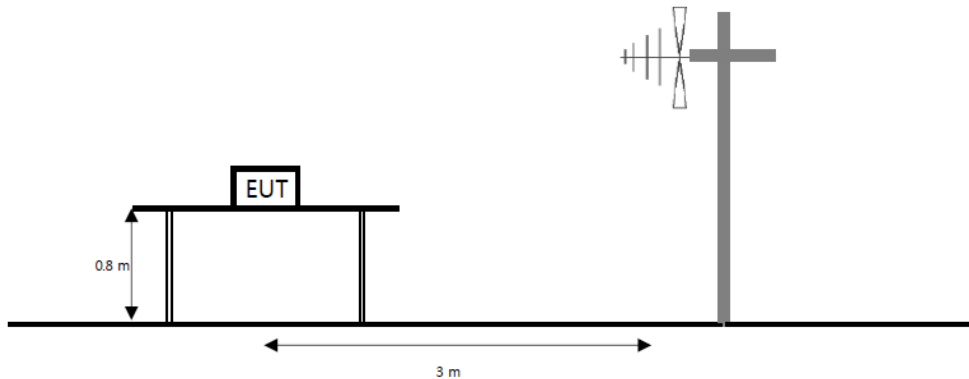
Parameter	Expanded uncertainty (±)	
Radiated spurious emissions	30 MHz ~ 1 GHz	3.7 dB
	Above 1 GHz	5.7 dB

5. Test results

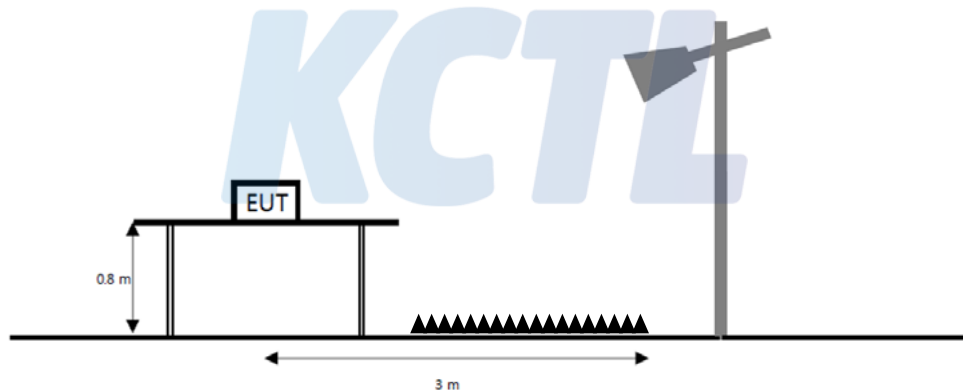
5.1. Radiated Power (ERP/EIRP)

Test setup

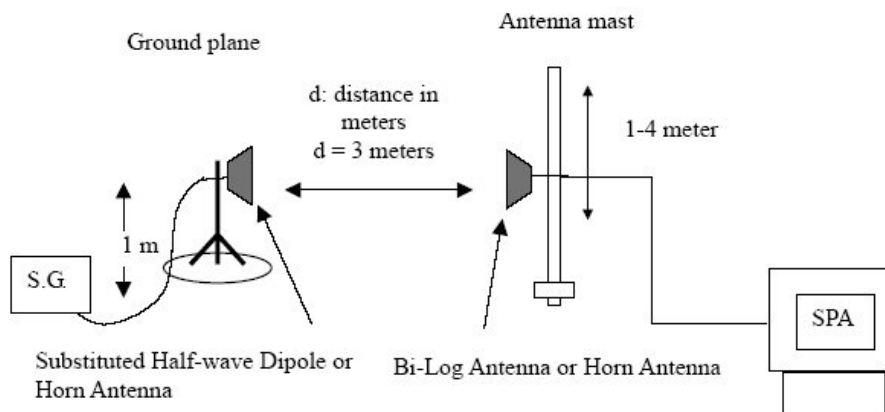
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



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

Test procedure

971168 D01 v03r01 - Section 5.2 and 5.8

ANSI 63.26-2015 – Section 5.2

ANSI/TIA-603-E-2016 - Section 2.2.17

Test settings

- 1) RBW = 1 % to 5 % of the OBW.
- 2) VBW $\geq 3 \times$ 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.

Test results

Test mode: LTE Band 26

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
3 M	QPSK	815.5	V	-0.30	3.73	22.55	18.52	0.071

Note.

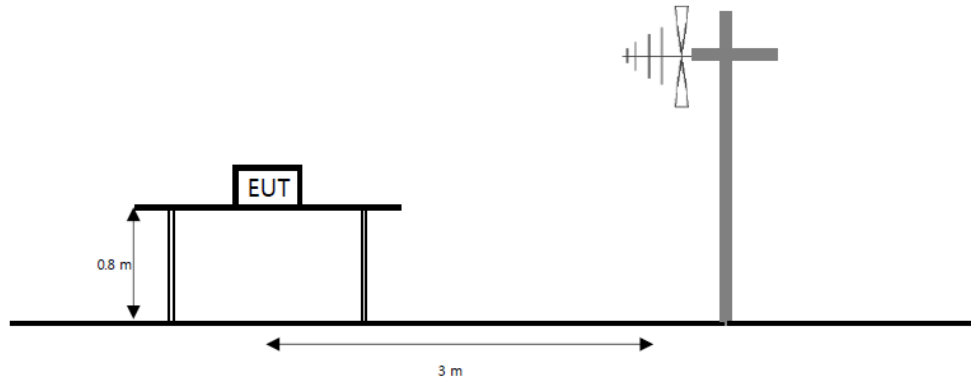
1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

KCTL

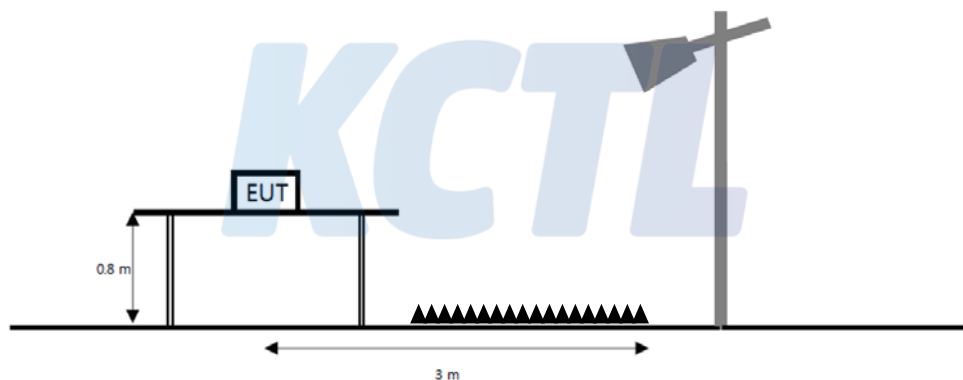
5.2. Radiated Spurious Emissions

Test setup

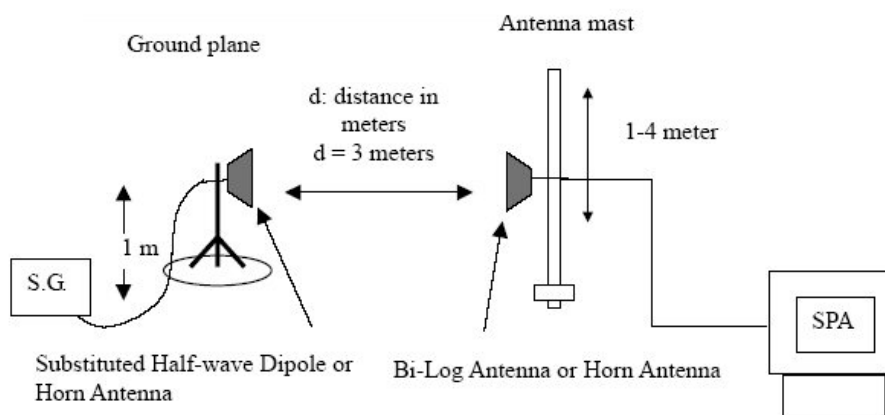
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



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

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

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

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 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.

Test results (Above 1 000 MHz)

Test mode : LTE Band 26

Frequency(MHz) : 822.5

Channel : 26775

Bandwidth(MHz) : 3

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[MHz]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 645.30	H	5.95	5.29	-56.16	-55.50	-13.00	42.50
	2 467.90	H	6.13	6.49	-51.24	-51.60	-13.00	38.60
	3 289.15	V	7.71	8.34	-54.87	-55.50	-13.00	42.50
	4 112.65	V	8.83	9.67	-55.46	-56.30	-13.00	43.30

Note.

1. Limit Calculation(dBm)= 43 + 10log(P_[Watts])

KCTL

6. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV30	100807	21.07.29
Spectrum Analyzer	AGILENT	N9040B	MY57010132	21.07.29
Vector Signal Generator	R&S	SMBV100A	257566	21.07.13
Signal Generator	R&S	SMR40	100007	21.04.08
Signal Generator	R&S	SMB100A	176206	21.01.21
Wideband Radio Communication Tester	R&S	CMW500	141780	21.04.16
Wideband Radio Communication Tester	R&S	CMW500	132423	21.03.12
Biconical VHF-UHF Broadband Antenna	SCHWARZBECK	VUBA9117	275	22.04.09
Bilog Antenna	Teseq GmbH	CBL 6143A	35039	21.05.21
Horn Antenna	ETS.lindgren	3117	00227509	21.09.23
Horn Antenna	ETS.lindgren	3117	161225	21.05.12
Horn Antenna	ETS.lindgren	3116	00086632	21.02.17
Horn Antenna	ETS.lindgren	3116	00086635	21.05.12
High pass Filter	Wainwright Instruments GmbH	WHKX3.0/18G-12SS	44	21.01.21
High pass Filter	Wainwright Instruments GmbH	WHKX1.0/1.5S-10SS	14	21.01.21
Attenuator	Weinschel ENGINEERING	10	AJ1239	21.05.15
Amplifier	SONOMA INSTRUMENT	310N	186280	21.01.21
Amplifier	L-3 Narda-MITEQ	AFS5-00101800-25-S-5	2054570	21.05.22
Amplifier	L-3 Narda-MITEQ	JS44-18004000-33-9P	2000996	21.01.22
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

End of test report