

FCC RADIO TEST REPORT

FCC ID: 2AJTUS550

Product: High precision industrial grade
GNSS receiver pad

Trade Name: SOUTH, SANDING, KOLIDA,
RUIDE, TIANYU, TEXCEL

Model Name: S550

Serial Model: S510, S520, S540, S560, D40,
D50, D60, K40, K50, K60

Report No.: STUEMO016072605210RF1

Prepared for

South Geo-science Technology Co., Ltd.
Room 301 South Building, No.24-26 Keyun Road, Tian He District,
Guangzhou, China

Prepared by

BZT Testing Technology Co., Ltd.
1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street,
Bao'an District, Shenzhen P.R. China
Telephone: +86 (0) 0755 33071680, Fax:+86 (0) 0755 27341758

TEST RESULT CERTIFICATION

Applicant's name: South Geo-science Technology Co., Ltd.
Address: Room 301 South Building, No.24-26 Keyun Road, Tian He District,
Guangzhou, China
Manufacture's Name: Guangzhou South Satellite Navigation Co., Ltd.
Address: Layer 2-3, N0.52-54 Jian Zhong Road, Tian He District, Guangzhou,
China

Product description

Product name: High precision industrial grade GNSS receiver pad
Model and/or type reference: S550, S510, S520, S540, S560, D40, D50, D60, K40, K50, K60

Standards.....: FCC Part 22H and 24E

Test procedure FCC Part22(H):2015,FCC Part 24(E):2015,ANSI/TIA-603-D:2010

This device described above has been tested by BZT, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

This report shall not be reproduced except in full, without the written approval of BZT, this document may be altered or revised by BZT, personal only, and shall be noted in the revision of the document.

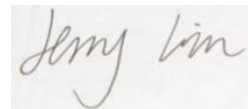
Date of Test

Date (s) of performance of tests: 7 Aug. 2016 ~17 Aug. 2016

Date of Issue: 17 Aug. 2016

Test Result.....: **Pass**

Testing Engineer :



(Jerry Lin)

Technical Manager :



(Jimmy Yao)

Authorized Signatory :



(Terry Yang)

CONTENTS

1. REPORT REVISION HISTORY	4
2. CUSTOMER INFORMATION	4
3. TEST SITE INFORMATION	4
4. EQUIPMENT UNDER TEST (EUT) INFORMATION	5
5. TEST SUMMARY	8
6. MEASUREMENTS, EXAMINATION AND DERIVED RESULTS	9
6.1 RF EXPOSURE (SAR)	9
6.2 RF OUTPUT POWER	10
6.3 PEAK-AVERAGE RATIO	16
6.4 OCCUPIED BANDWIDTH	18
6.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS	22
6.6 SPURIOUS RADIATED EMISSIONS	27
6.7 BAND EDGE	33
6.8 FREQUENCY STABILITY	37
ANNEX A. TEST INSTRUMENT	41
ANNEX B. TEST SETUP PHOTOGRAPHS	42
ANNEX C. TEST SETUP AND SUPPORTING EQUIPMENT	43

1. Report Revision History

Report No.	Report Version	Description	Issue Date
STUEMO016072605210RF1	NONE	Original	17 Aug. 2016

2. Customer information

Applicant Name	South Geo-science Technology Co., Ltd.
Applicant Add	Room 301 South Building, No.24-26 Keyun Road, Tian He District, Guangzhou, China
Manufacturer	Guangzhou South Satellite Navigation Co., Ltd.
Manufacturer Add	Layer 2-3, N0.52-54 Jian Zhong Road, Tian He District, Guangzhou, China

3. Test site information

Lab performing tests	BZT Testing Technology Co., Ltd.
Lab Address	Buliding 17, Xinghua Road Xingwei industrial Park Fuyong, Baoan District, Shenzhen, Guangdong, China
FCC Test Site No.	701733

4. Equipment under Test (EUT) Information

Description of EUT:	High precision industrial grade GNSS receiver pad
Main Model:	S550
Serial Model:	S510, S520, S540, S560, D40, D50, D60, K40, K50, K60
Equipment Category :	PCE
Antenna Gain:	2G/3G antenna: 3dbi BT/WIFI antenna:2dBi
Type of Modulation:	GSM / GPRS: GMSK UMTS-FDD: QPSK, 16QAM 802.11b/g/n: DSSS, OFDM Bluetooth: GFSK, π /4DQPSK, 8DPSK BLE: GFSK
RF Operating Frequency (ies):	GSM850 TX: 824.2 ~ 848.8 MHz; RX: 869.2 ~ 893.8 MHz PCS1900 TX: 1850.2 ~ 1909.8 MHz; RX: 1930.2 ~ 1989.8 MHz UMTS-FDD Band V TX: 826.4 ~ 846.6 MHz; RX: 871.4 ~ 891.6 MHz UMTS-FDD Band II TX:1852.4 ~ 1907.6 MHz; RX: 1932.4 ~ 1987.6 MHz WIFI:802.11b/g/n(20M): 2412-2462 MHz Bluetooth& BLE: 2402-2480 MHz
ERP/EIRP:	GSM850: 25.92 dBm / ERP PCS1900: 22.98 dBm / EIRP UMTS-FDD Band V : 19.27 dBm / ERP UMTS-FDD Band II : 18.82 dBm/ EIRP
Number of Channels:	GSM 850: 124CH PCS1900: 299CH UMTS-FDD Band V : 102CH UMTS-FDD Band II : 277CH WIFI :802.11b/g/n(20M): 11CH Bluetooth: 79CH BLE: 40CH

Port:

Power Port, Earphone Port, USB Port

Input Power:	Adapter:
	Model: DSA-60PFC-121
	Input: AC 100-240V; 50/60Hz; 1.5A
	Output: DC 12V, 5A
	Battery:
	Model: BTNF-L3713W
	Capacity: 7200mAh
	Related Voltage: 3.7V
Trade Name :	SOUTH, SANDING, KOLIDA, RUIDE, TIANYU, TEXCEL
GPRS Multi-slot class	8/10/12

5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

FCC Rules	Description of Test	Result
§ 1.1307; § 2.1093	RF Exposure (SAR)	Compliance
§2.1046; § 22.913(a); § 24.232(c);	RF Output Power	Compliance
§ 24.232 (d) ;	Peak-Average Ratio	Compliance
§ 2.1049; § 22.905; § 22.917; § 24.238;	99% & -26 dB Occupied Bandwidth	Compliance
§ 2.1051; § 22.917(a); § 24.238(a);	Spurious Emissions at Antenna Terminal	Compliance
§ 2.1053; § 22.917(a); § 24.238(a)	Field Strength of Spurious Radiation	Compliance
§ 22.917(a); § 24.238(a);	Out of band emission, Band Edge	Compliance
§ 2.1055; § 22.355; § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Compliance

Note: Testing was performed by configuring EUT to maximum output power status, the declared output power class for different

Measurement Uncertainty

Emissions		
Test Item	Description	Uncertainty
Band Edge and Radiated Spurious Emissions	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
-	-	-

6. MEASUREMENTS, EXAMINATION AND DERIVED RESULTS

6.1 RF Exposure (SAR)

Test Result: Pass

The EUT is a portable device, thus requires SAR evaluation;

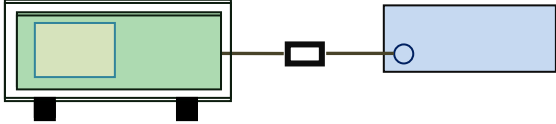
Please refer to RF Exposure Evaluation Report: STUEMO016072605210RF4

6.2 RF Output Power

Temperature	24°C
Relative Humidity	57%
Atmospheric Pressure	1015mbar

Requirement(s):

Spec	Item	Requirement	Applicable
§22.913 (a)	a)	ERP:38.45dBm	☒
§24.232 (c)	b)	EIRP:33dBm	☒
§27.50 (c)	c)	EIRP: 30dBm	☒

Test Setup	
------------	--

Test Procedure	For Conducted Power: - The transmitter output port was connected to base station. - Set EUT at maximum power through base station. - Select lowest, middle, and highest channels for each band and different test mode. For ERP/EIRP: According with KDB 971168 v02r02 - The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable. - The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis. - The frequency range up to tenth harmonic of the fundamental frequency was investigated. - Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-
----------------	--

	radiating cable. The absolute levels of the spurious emissions were measured by the substitution. - Spurious emissions in dB = $10 \log (\text{TX power in Watts}/0.001)$ – the absolute level - Spurious attenuation limit in dB = $43 + 10 \text{ Log}_{10} (\text{power out in Watts})$.
Remark	
Result	☒ Pass ☐ Fail

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Conducted Power

GSM Mode:

Conducted Power Measurement Results(GSM 850/1900)

GSM 850		Burst Conducted power (dBm)			/	Average power (dBm)		
		Channel/Frequency(MHz)				Channel/Frequency(MHz)		
		128/824.2	190/836.6	251/848.8		128/824.2	190/836.6	251/848.8
GSM		32.54	32.76	32.67	-9.03dB	23.51	23.73	23.64
GPRS (GMSK)	1TX slot	32.46	32.20	32.21	-9.03dB	23.43	23.17	23.18
	2TX slot	30.34	30.34	30.35	-6.02dB	24.32	24.32	24.33
	3TX slot	28.42	28.39	28.34	-4.26dB	24.16	24.13	24.08
	4TX slot	27.23	27.23	27.40	-3.01dB	24.22	24.22	24.39
GSM 1900		Burst Conducted power (dBm)			/	Average power (dBm)		
		Channel/Frequency(MHz)				Channel/Frequency(MHz)		
		512/ 1850.2	661/ 1880	810/ 1909.8		512/ 1850.2	661/ 1880	810/ 1909.8
GSM		29.64	29.85	29.70	-9.03dB	20.61	20.82	20.67
GPRS (GMSK)	1TX slot	29.23	29.52	29.73	-9.03dB	20.20	20.49	20.70
	2TX slot	27.39	27.30	27.20	-6.02dB	21.37	21.28	21.18
	3TX slot	26.30	26.44	26.31	-4.26dB	22.04	22.18	22.05
	4TX slot	25.72	25.27	25.19	-3.01dB	22.71	22.26	22.18

Note: Since GSM mode has higher power, so the test items below were not performed to GPRS mode.

UMTS Mode:

Conducted Power Measurement Results(WCDMA Band II)

Item	band	WCDMA Band V result (dBm)			WCDMA Band II result (dBm)		
		Channel/Frequency(MHz)			Channel/Frequency(MHz)		
	ARFCN	4132/826.4	4183/836.6	4233/846.6	9262/1852.4	9400/1880.0	9538/1907.6
RMC	12.2kbps	23.78	23.45	23.22	23.66	23.24	23.15
AMR	12.2kbps	23.75	23.44	23.19	23.63	23.22	23.11
HSDPA	Sub - Test 1	22.21	22.26	22.22	22.33	22.23	22.11
	Sub - Test 2	22.18	21.33	22.18	22.45	21.55	22.32
	Sub - Test 3	22.25	21.25	22.36	22.41	21.36	22.55
	Sub - Test 4	21.15	21.43	21.24	21.41	21.74	21.34
HSUPA	Sub - Test 1	20.74	21.25	20.24	20.32	21.36	20.35
	Sub - Test 2	20.44	20.23	20.49	20.41	20.33	20.26
	Sub - Test 3	21.35	21.33	21.74	21.20	21.41	21.22
	Sub - Test 4	20.51	20.14	20.32	20.11	20.25	20.36
	Sub - Test 5	20.01	21.36	20.21	20.41	21.46	20.37

ERP & EIRP

ERP for Cellular Band (Part 22H)

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization	Antenna Gain correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)
824.2	17.49	V	6.8	0.53	23.76	38.45
824.2	19.16	H	6.8	0.53	25.43	38.45
836.6	17.65	V	6.8	0.53	23.92	38.45
836.6	18.94	H	6.8	0.53	25.21	38.45
848.8	17.21	V	6.9	0.53	23.58	38.45
848.8	19.55	H	6.9	0.53	25.92	38.45

EIRP for PCS Band (Part 24E)

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization	Antenna Gain correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)
1850.2	14.15	V	7.88	0.85	21.18	33
1850.2	15.41	H	7.88	0.85	22.44	33
1880	14.37	V	7.88	0.85	21.40	33
1880	15.62	H	7.88	0.85	22.65	33
1909.8	14.32	V	7.86	0.85	21.33	33
1909.8	15.97	H	7.86	0.85	22.98	33

ERP for UMTS-FDD Band V (Part 22H)

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization	Antenna Gain correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)
826.4	12.12	V	6.8	0.53	18.39	38.45
826.4	12.62	H	6.8	0.53	18.89	38.45
835	12.35	V	6.8	0.53	18.62	38.45
835	12.74	H	6.8	0.53	19.01	38.45
846.6	12.48	V	6.9	0.53	18.85	38.45
846.6	12.9	H	6.9	0.53	19.27	38.45

EIRP for UMTS-FDD Band II (Part 24E)

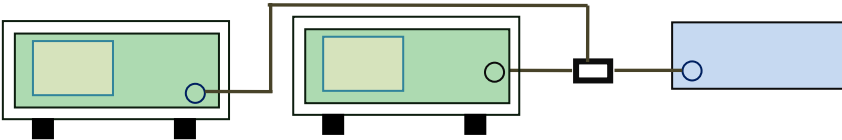
Frequency (MHz)	Substituted level (dBm)	Antenna Polarization	Antenna Gain correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)
1852.4	10.78	V	7.88	0.85	17.81	33
1852.4	11.54	H	7.88	0.85	18.57	33
1880	11.21	V	7.88	0.85	18.24	33
1880	11.79	H	7.88	0.85	18.82	33
1907.6	10.95	V	7.86	0.85	17.96	33
1907.6	11.52	H	7.86	0.85	18.53	33

6.3 Peak-Average Ratio

Temperature	24°C
Relative Humidity	57%
Atmospheric Pressure	1015mbar

Requirement(s):

Spec	Item	Requirement	Applicable
§24.232(d) § 27.50(d)	a)	The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	☒

Test Setup	
------------	--

Test Procedure	According with KDB 971168 v02r02 1. The signal analyzer' s CCDF measurement profile is enabled 2. Frequency = carrier center frequency 3. Measurement BW > Emission bandwidth of signal 4. The signal analyzer was set to collect one million samples to generate the CCDF curve 5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal “ RF Burst” trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the “ on time” of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power
----------------	---

Remark	
Result	☒ Pass ☐ Fail

Test Data ☒ Yes ☐ N/A
 Test Plot ☐ Yes (See below) ☒ N/A

GSM 1900 PK-AV POWER(PART 24E)

Frequency (MHz)	Conducted power(dBm)		Peak-Average Ratio(PAR)
	Peak	Average	
1850.2	30.42	30.3	0.12
1880	30.51	30.4	0.11
1909.8	30.12	30.0	0.12

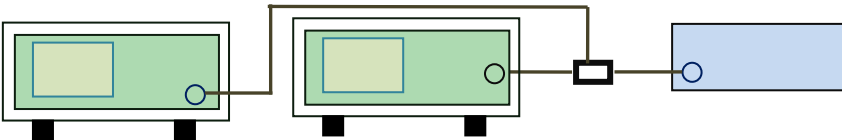
UMTS-FDD Band II PK-AV POWER(PART 24E)

Frequency (MHz)	Conducted power(dBm)		Peak-Average Ratio(PAR)
	Peak	Average	
1852.4	27.58	24.12	3.46
1880	27.42	24.51	2.91
1907.6	27.48	24.63	2.85

6.4 Occupied Bandwidth

Temperature	24°C
Relative Humidity	57%
Atmospheric Pressure	1015mbar

Requirement(s):

Spec	Item	Requirement	Applicable
§2.1049, §22.917, §22.905 §24.238 §27.53(a)	a)	99% Occupied Bandwidth(kHz)	☒
	b)	26 dB Bandwidth(kHz)	☒
Test Setup			
Test Procedure	- The EUT was connected to Spectrum Analyzer and Base Station via power divider. - The 99% and 26 dB occupied bandwidth (BW) of the middle channel for the highest RF powers.		
Remark			
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Cellular Band (Part 22H) result

Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	26 dB Bandwidth (kHz)
128	824.2	247.0233	317.898
190	836.6	246.9289	317.833
251	848.8	244.7856	314.606

PCS Band (Part 24E) result

Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	26 dB Bandwidth (kHz)
512	1850.2	249.4958	317.681
661	1880.0	241.9120	319.164
810	1909.8	246.2940	320.104

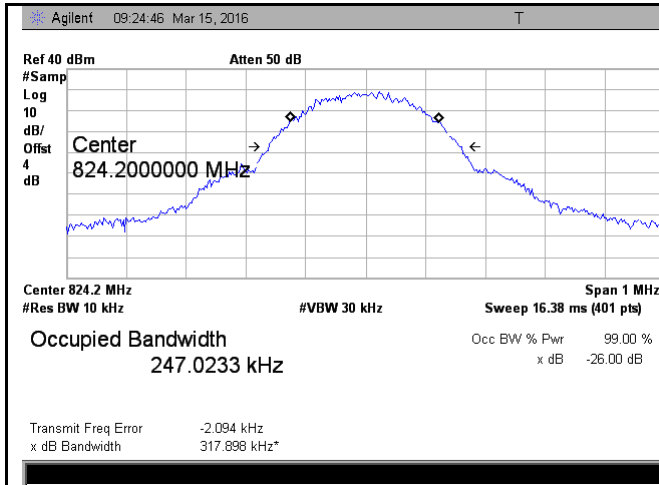
UMTS-FDD Band V (Part 22H)

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
4132	826.4	4.1506	4.698
4175	835.0	4.1469	4.679
4233	846.6	4.1494	4.670

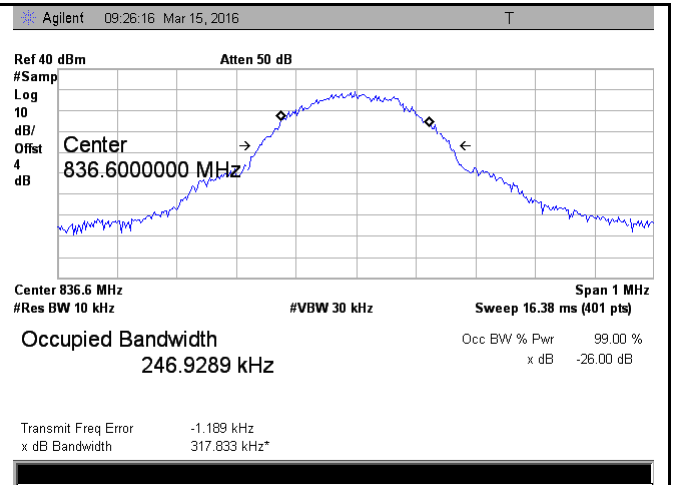
UMTS-FDD Band II (Part 24E)

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
9262	1852.4	4.1622	4.663
9400	1880.0	4.1581	4.728
9538	1907.6	4.1562	4.689

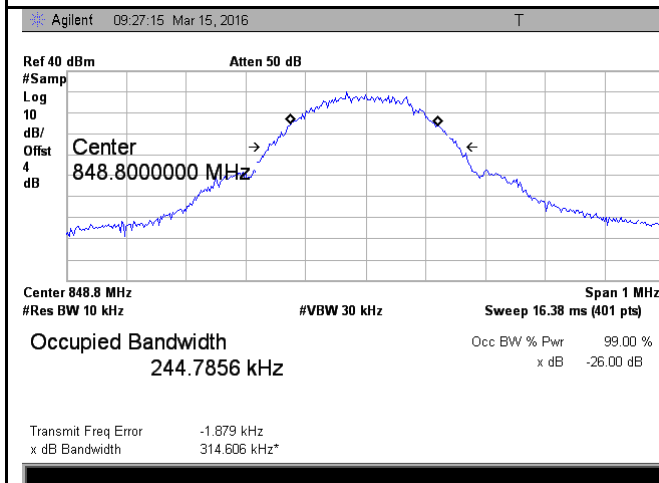
Test Plots



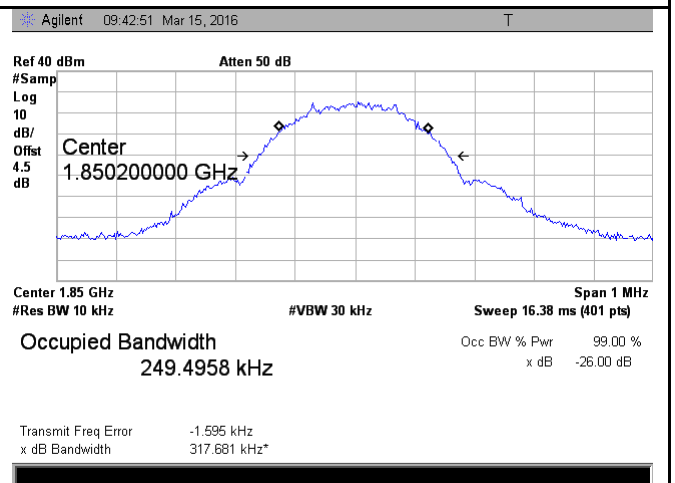
GSM 850 BW - Low CH 824.2MHz



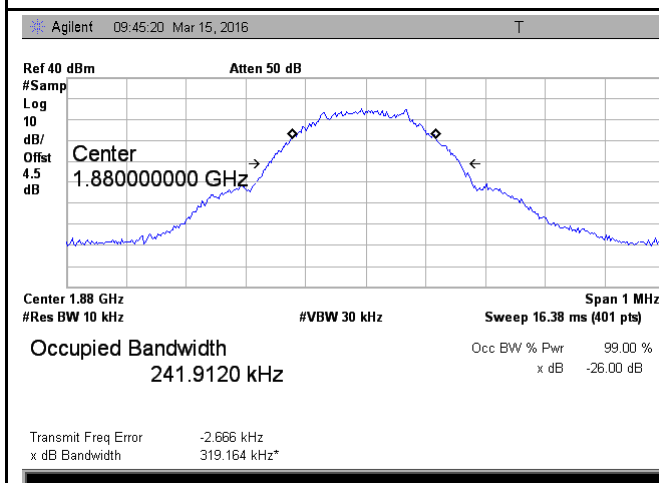
GSM 850 BW - Mid CH 836.6MHz



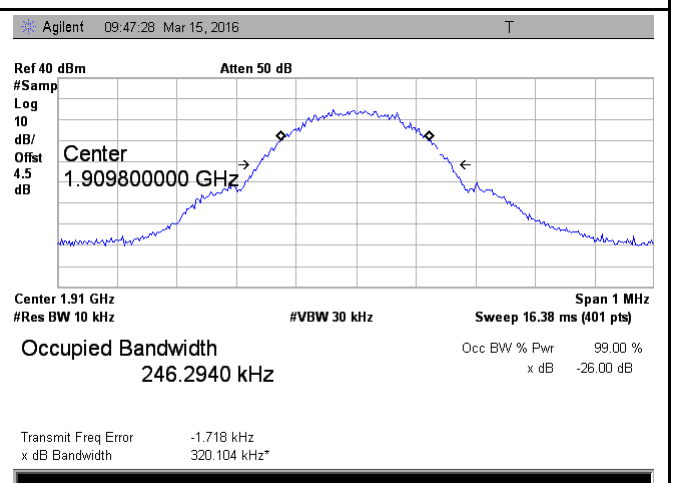
GSM 850 BW - High CH 848.8MHz



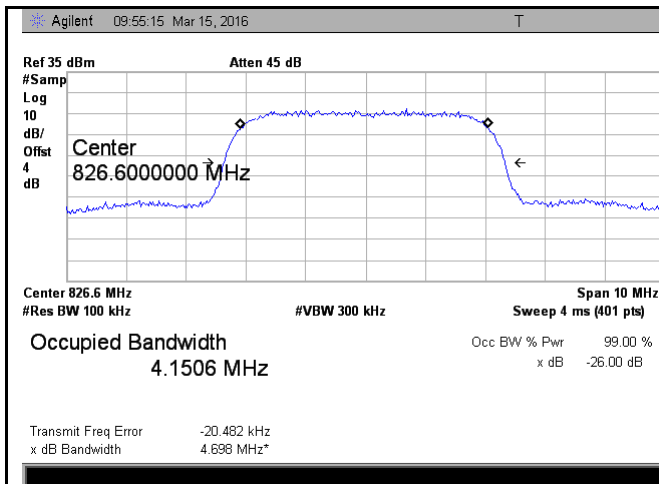
PCS 1900 BW - Low CH 1850.2MHz



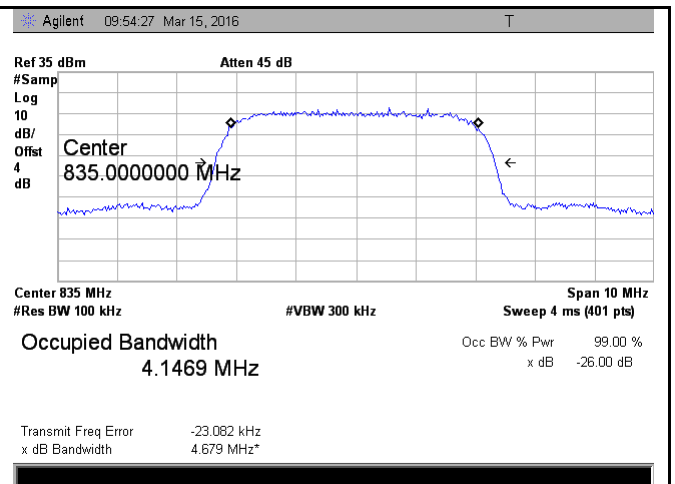
PCS 1900 BW - Mid CH 1880MHz



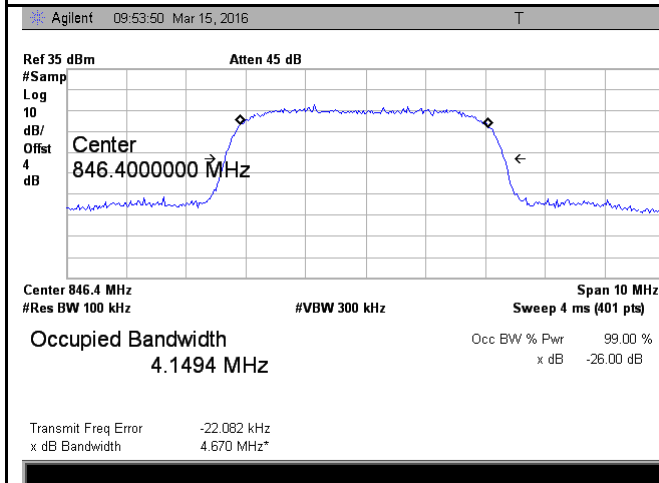
PCS 1900 BW - High CH 1909.8MHz



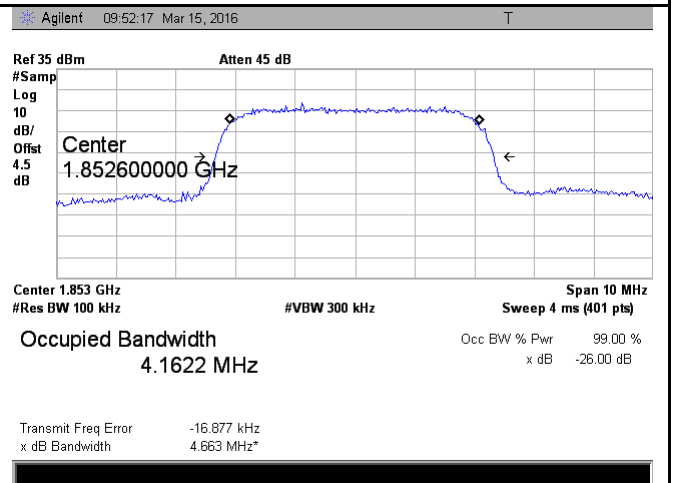
Band V BW - Low CH 826.6 MHz



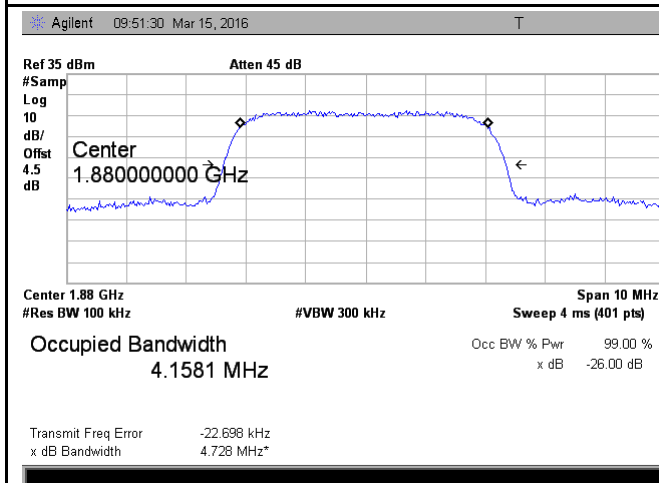
Band V BW - Mid CH 835.0 MHz



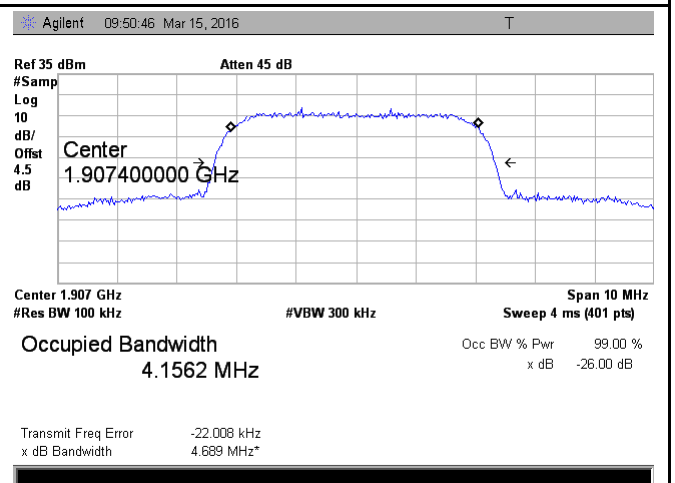
Band V BW - High CH 846.4 MHz



Band II BW - Low CH 1852.4 MHz



Band II BW - Mid CH 1880 MHz

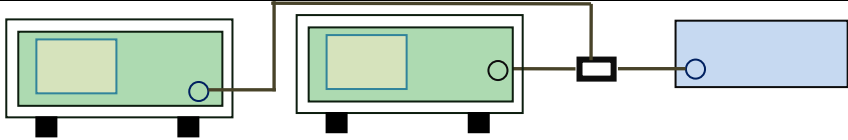


Band II BW - High CH 1907.6 MHz

6.5 Spurious Emissions at Antenna Terminals

Temperature	24°C
Relative Humidity	57%
Atmospheric Pressure	1015mbar

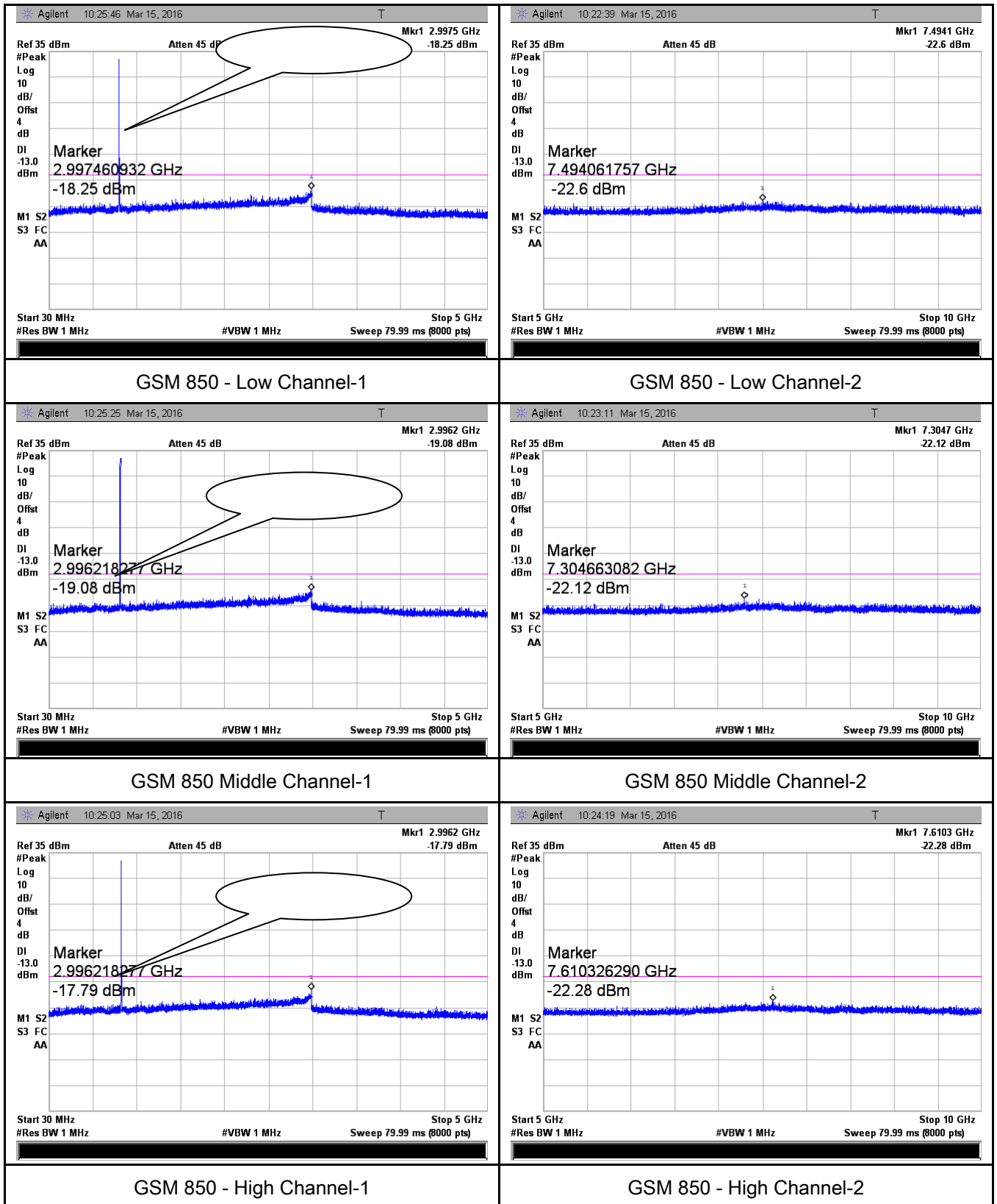
Requirement(s):

Spec	Item	Requirement	Applicable
§2.1051, §22.917(a)& §24.238(a) § 27.53(h)	a)	The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB	☒
Test Setup			
Test Procedure	- The EUT was connected to Spectrum Analyzer and Base Station via power divider. - The Band Edges of low and high channels for the highest RF powers were measured. - Setting RBW as roughly BW/100.		
Remark			
Result	☒ Pass ☐ Fail		

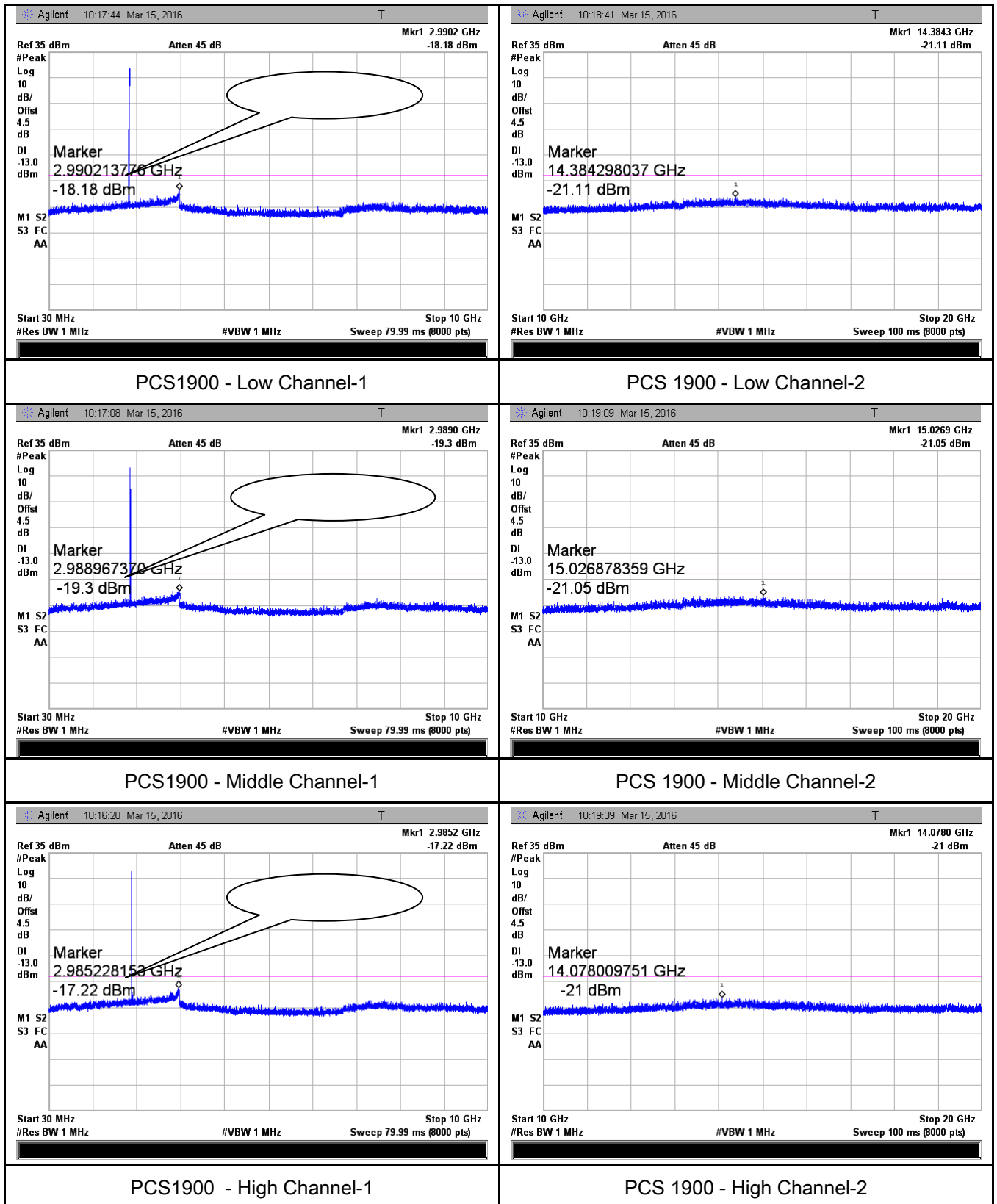
Test Data ☒ Yes ☐ N/A
 Test Plot ☒ Yes (See below) ☐ N/A

Test Plots

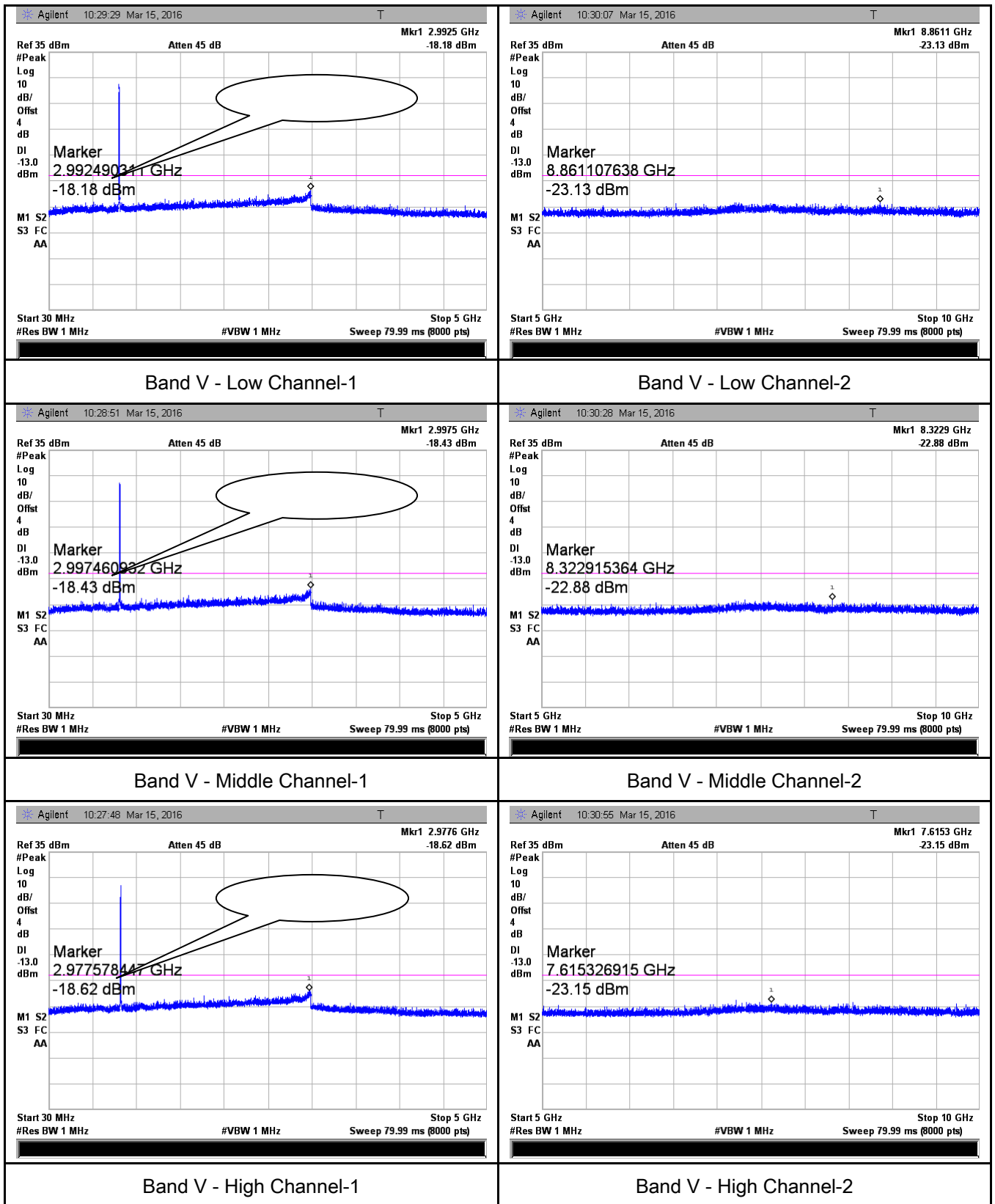
Cellular Band (Part 22H) result



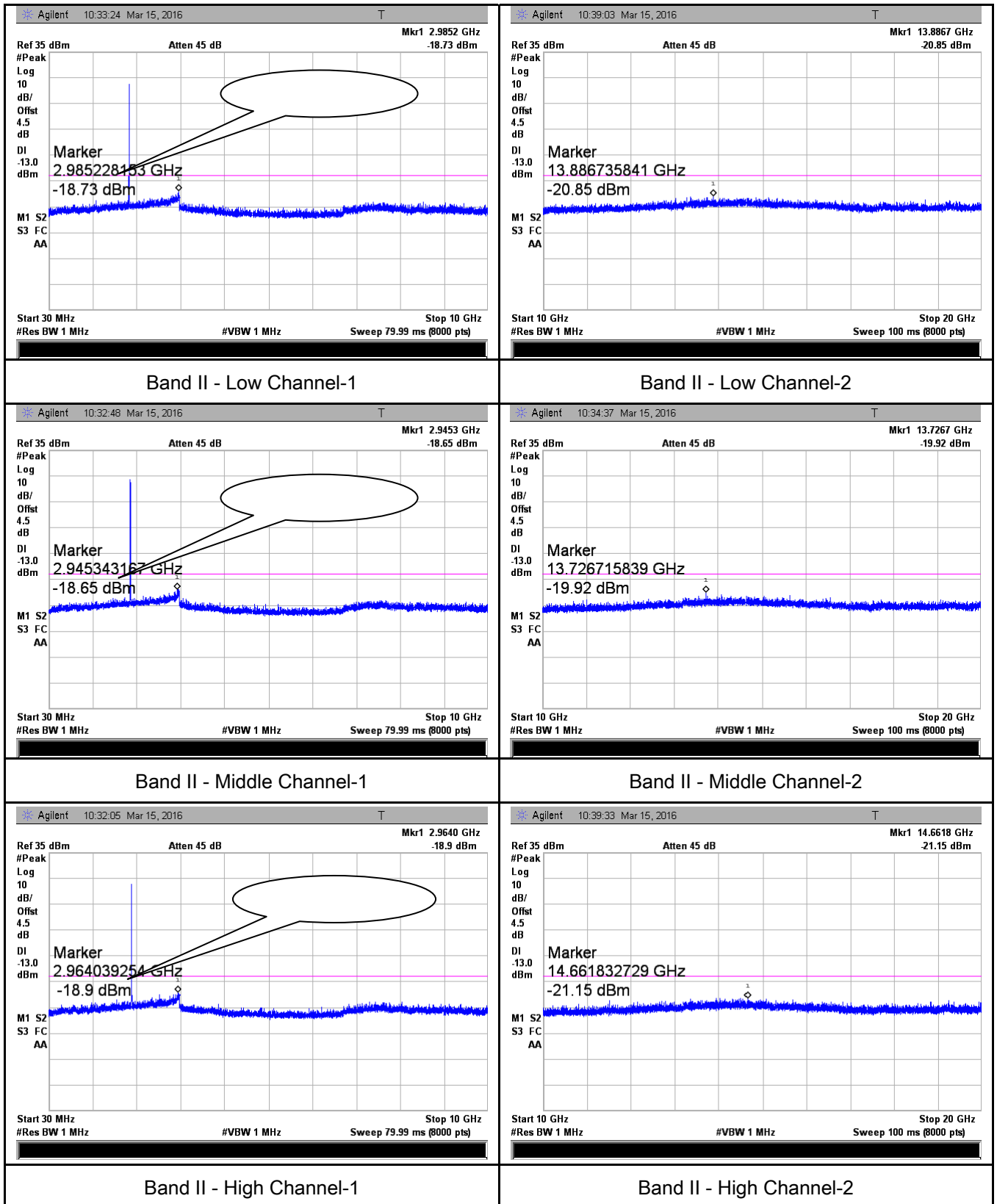
PCS Band (Part24E) result



UMTS-FDD Band V (Part 22H)



UMTS-FDD Band II (Part 24E)

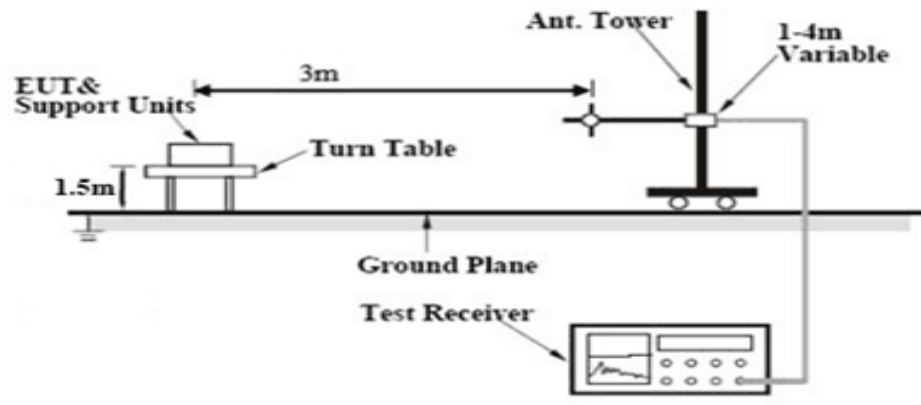


6.6 Spurious Radiated Emissions

Temperature	22°C
Relative Humidity	59%
Atmospheric Pressure	1017mbar

Requirement(s):

Spec	Item	Requirement	Applicable
§2.1053, §22.917 & §24.238 § 27.53(h)	a)	The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.	☒

Test setup	
------------	---

Test Procedure	- The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable. - The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis. - Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution. Sample Calculation: EUT Field Strength = Raw Amplitude (dBµV/m) – Amplifier Gain (dB) + Antenna Factor (dB) + Cable Loss (dB) + Filter Attenuation (dB, if used)
----------------	---

Remark	
Result	☒ Pass ☐ Fail

Test Data	☒ Yes	☐ N/A
Test Plot	☐ Yes (See below)	☒ N/A

Cellular Band (Part 22H) result

Low channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1648.4	-42.37	V	7.95	0.78	-35.2	-13	-22.20
1648.4	-43.69	H	7.95	0.78	-36.52	-13	-23.52
413.6	-51.98	V	6.5	0.3	-45.78	-13	-32.78
852.7	-48.16	H	6.9	0.44	-41.7	-13	-28.70

Middle channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1673.2	-42.38	V	7.95	0.78	-35.21	-13	-22.21
1673.2	-42.98	H	7.95	0.78	-35.81	-13	-22.81
413.5	-51.16	V	6.5	0.3	-44.96	-13	-31.96
851.8	-50.69	H	6.9	0.44	-44.23	-13	-31.23

High channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1697.6	-42.03	V	7.95	0.78	-34.86	-13	-21.86
1697.6	-41.78	H	7.95	0.78	-34.61	-13	-21.61
413.1	-53.69	V	6.5	0.3	-47.49	-13	-34.49
852.1	-50.98	H	6.9	0.44	-44.52	-13	-31.52

Note:

- 1, The testing has been conformed to $10 \times 848.8 \text{ MHz} = 8,488 \text{ MHz}$
- 2, All other emissions more than 30 dB below the limit

PCS Band (Part24E) result

Low channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3700.4	-49.97	V	10.25	2.73	-42.45	-13	-29.45
3700.4	-48.84	H	10.25	2.73	-41.32	-13	-28.32
417.8	-54.13	V	6.5	0.3	-47.93	-13	-34.93
850.4	-51.64	H	6.9	0.44	-45.18	-13	-32.18

Middle channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3760	-50.98	V	10.25	2.73	-43.46	-13	-30.46
3760	-49.42	H	10.25	2.73	-41.9	-13	-28.90
417.6	-54.26	V	6.5	0.3	-48.06	-13	-35.06
850.9	-52.77	H	6.9	0.44	-46.31	-13	-33.31

High channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3819.6	-49.13	V	10.36	2.73	-41.5	-13	-28.50
3819.6	-48.74	H	10.36	2.73	-41.11	-13	-28.11
417.3	-54.98	V	6.5	0.3	-48.78	-13	-35.78
850.8	-51.23	H	6.9	0.44	-44.77	-13	-31.77

Note:

- 1, The testing has been conformed to $10 \times 1909.8 \text{ MHz} = 19,098 \text{ MHz}$
- 2, All other emissions more than 30 dB below the limit

UMTS-FDD Band V (Part 22H)

Low channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1652.8	-46.95	V	7.95	0.78	-39.78	-13	-26.78
1652.8	-44.68	H	7.95	0.78	-37.51	-13	-24.51
411.8	-54.12	V	6.5	0.3	-47.92	-13	-34.92
852.4	-51.68	H	6.9	0.44	-45.22	-13	-32.22

Middle channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1670	-48.97	V	7.95	0.78	-41.8	-13	-28.80
1670	-47.24	H	7.95	0.78	-40.07	-13	-27.07
411.4	-54.13	V	6.5	0.3	-47.93	-13	-34.93
852.1	-51.69	H	6.9	0.44	-45.23	-13	-32.23

High channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1693.2	-48.97	V	7.95	0.78	-41.8	-13	-28.80
1693.2	-47.86	H	7.95	0.78	-40.69	-13	-27.69
411.9	-54.26	V	6.5	0.3	-48.06	-13	-35.06
852.7	-51.97	H	6.9	0.44	-45.51	-13	-32.51

Note:

- 1, The testing has been conformed to $10 \times 846.6 \text{ MHz} = 8,466 \text{ MHz}$
- 2, All other emissions more than 30 dB below the limit

UMTS-FDD Band II (Part 24E)

Low channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3704.8	-48.88	V	10.25	2.73	-41.36	-13	-28.36
3704.8	-50.79	H	10.25	2.73	-43.27	-13	-30.27
414.2	-54.12	V	6.5	0.3	-47.92	-13	-34.92
852.4	-51.48	H	6.9	0.44	-45.02	-13	-32.02

Middle channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3760	-47.98	V	10.25	2.73	-40.46	-13	-27.46
3760	-49.36	H	10.25	2.73	-41.84	-13	-28.84
413.9	-54.88	V	6.5	0.3	-48.68	-13	-35.68
851.7	-51.23	H	6.9	0.44	-44.77	-13	-31.77

High channel

Frequency (MHz)	Substituted level (dBm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3815.2	-48.16	V	10.36	2.73	-40.53	-13	-27.53
3815.2	-49.53	H	10.36	2.73	-41.9	-13	-28.9
414.9	-54.24	V	6.5	0.3	-48.04	-13	-35.04
852.6	-49.11	H	6.9	0.44	-42.65	-13	-29.65

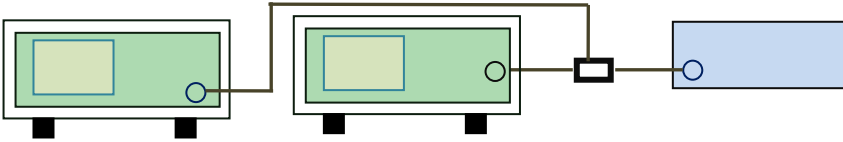
Note:

- 1, The testing has been conformed to $10 \times 1907.6 \text{ MHz} = 19,076 \text{ MHz}$
- 2, All other emissions more than 30 dB below the limit

6.7 Band Edge

Temperature	24°C
Relative Humidity	57%
Atmospheric Pressure	1015mbar

Requirement(s):

Spec	Item	Requirement	Applicable
§22.917(a) §24.238(a) § 27.53(h)	a)	The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.	☒
Test setup			
Procedure	- The EUT was connected to Spectrum Analyzer and Base Station via power divider. - The Band Edges of low and high channels for the highest RF powers were measured. Setting RBW as roughly BW/100.		
Remark			
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Cellular Band (Part 22H) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.9950	-17.39	-13
849.0225	-19.57	-13

PCS Band (Part24E) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.9950	-15.48	-13
1910.0200	-15.98	-13

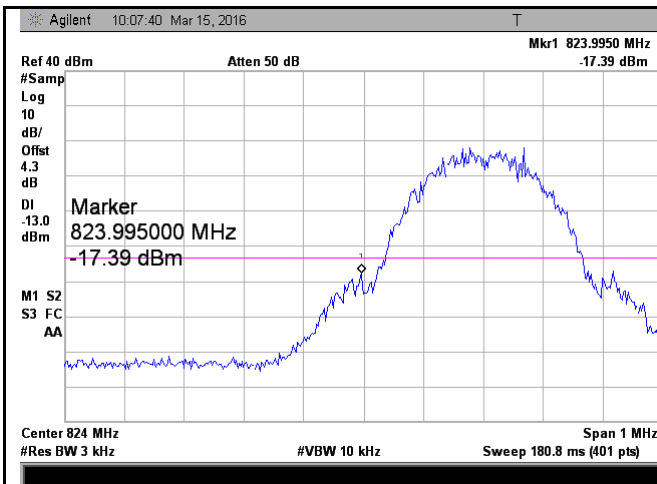
UMTS-FDD Band V (Part 22H)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.700	-29.14	-13
849.600	-30.52	-13

UMTS-FDD Band II (Part 24E)

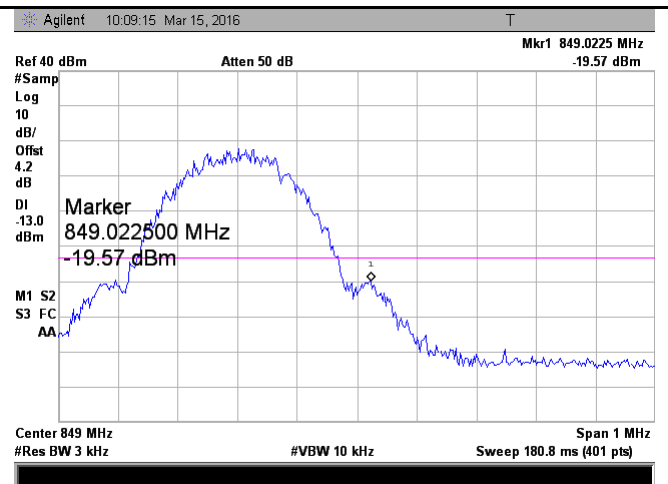
Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.125	-28.16	-13
1910.350	-25.93	-13

Test Plots



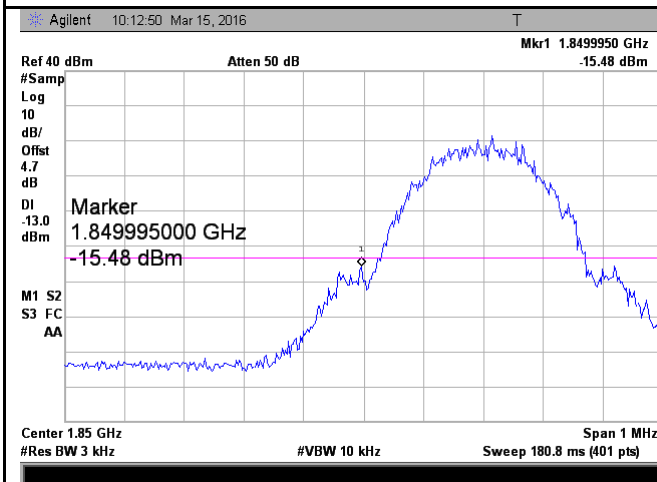
Cellular Band - Low Channel

Note: Offset=Cable loss (4.0) + 10log
(3.17/3)=4.0+0.3=4.3dB



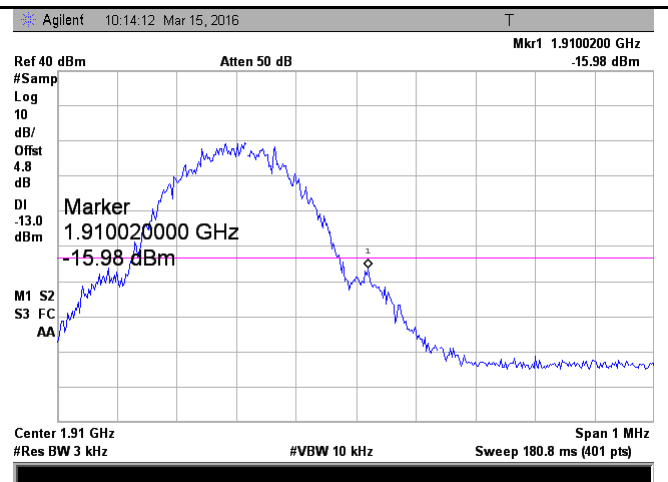
Cellular Band - High Channel

Note: Offset=Cable loss (4.0) + 10log
(3.14/3)=4.0+0.2=4.2dB



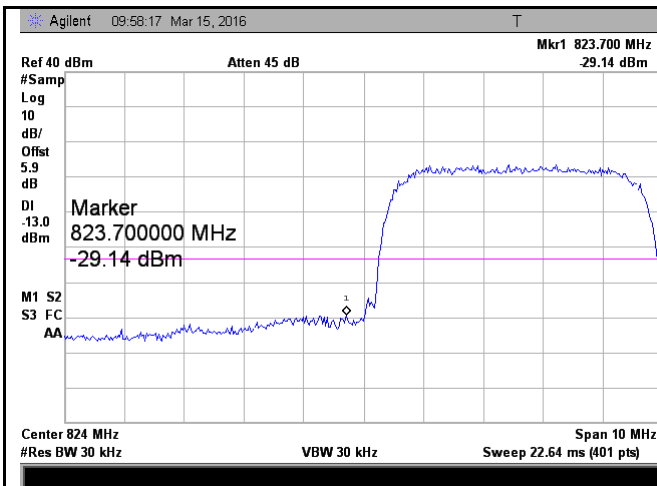
PCS Band - Low Channel

Note: Offset=Cable loss (4.5) + 10log
(3.17/3)=4.5+0.2=4.7dB



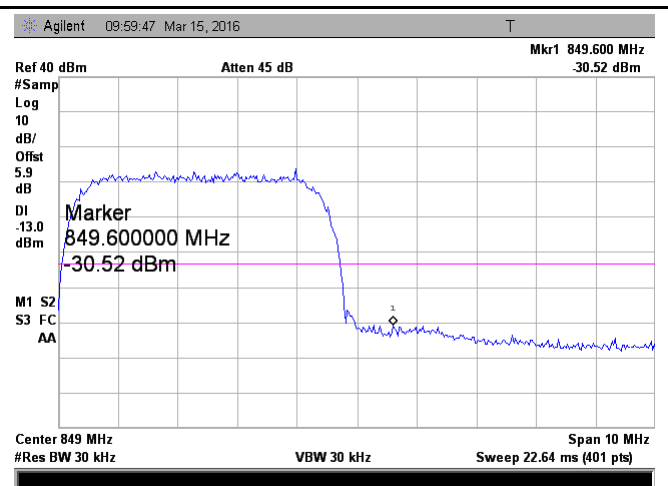
PCS Band - High Channel

Note: Offset=Cable loss (4.5) + 10log
(3.20/3)=4.5+0.3=4.8dB



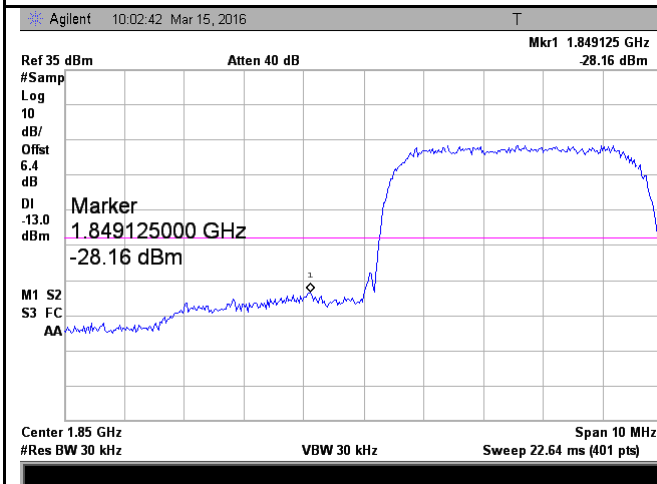
UMTS-FDD Band V - Low Channel

Note: Offset=Cable loss (4.0) + 10log
(46.98/30)=4.0+1.9=5.9 dB



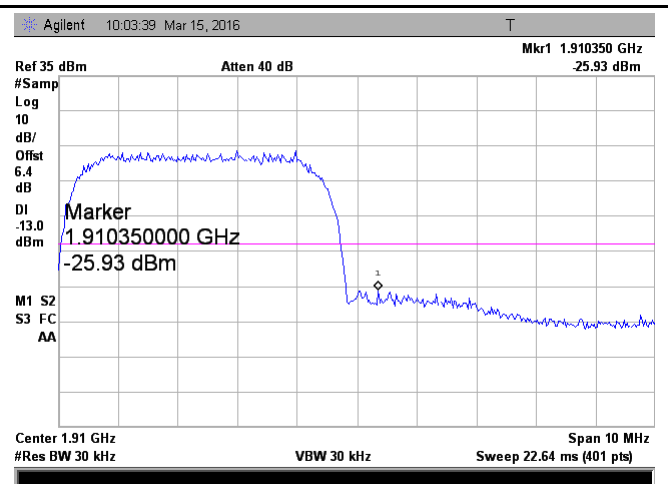
UMTS-FDD Band V - High Channel

Note: Offset=Cable loss (4.0) + 10log
(46.70/30)=4.0+1.9=5.9 dB



UMTS-FDD Band II - Low Channel

Note: Offset=Cable loss (4.5) + 10log
(46.63/30)=4.5+1.9=6.4 dB



UMTS-FDD Band II - High Channel

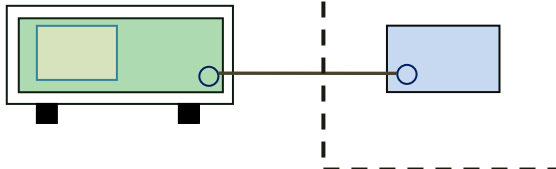
Note: Offset=Cable loss (4.5) + 10log
(46.89/30)=4.5+1.9=6.4 dB

6.8 Frequency Stability

Temperature	22°C
Relative Humidity	59%
Atmospheric Pressure	1017mbar

Requirement(s):

Spec	Item	Requirement	Applicable																																
§2.1055, §22.355 & §24.235 § 27.5(h); § 27.54	a)	According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below: Frequency Tolerance for Transmitters in the Public Mobile Services <table border="1"> <thead> <tr> <th>Frequency Range (MHz)</th><th>Base, fixed (ppm)</th><th>Mobile ≤ 3 watts (ppm)</th><th>Mobile ≤ 3 watts (ppm)</th></tr> </thead> <tbody> <tr> <td>25 to 50</td><td>20.0</td><td>20.0</td><td>50.0</td></tr> <tr> <td>50 to 450</td><td>5.0</td><td>5.0</td><td>50.0</td></tr> <tr> <td>45 to 512</td><td>2.5</td><td>5.0</td><td>.0</td></tr> <tr> <td>821 to 896</td><td>1.5</td><td>2.5</td><td>2.5</td></tr> <tr> <td>928 to 29.</td><td>5.0</td><td>N/A</td><td>N/A</td></tr> <tr> <td>929 to 960.</td><td>1.5</td><td>N/A</td><td>N/A</td></tr> <tr> <td>2110 to 2220</td><td>10.0</td><td>N/A</td><td>N/A</td></tr> </tbody> </table> According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized frequency block.	Frequency Range (MHz)	Base, fixed (ppm)	Mobile ≤ 3 watts (ppm)	Mobile ≤ 3 watts (ppm)	25 to 50	20.0	20.0	50.0	50 to 450	5.0	5.0	50.0	45 to 512	2.5	5.0	.0	821 to 896	1.5	2.5	2.5	928 to 29.	5.0	N/A	N/A	929 to 960.	1.5	N/A	N/A	2110 to 2220	10.0	N/A	N/A	
Frequency Range (MHz)	Base, fixed (ppm)	Mobile ≤ 3 watts (ppm)	Mobile ≤ 3 watts (ppm)																																
25 to 50	20.0	20.0	50.0																																
50 to 450	5.0	5.0	50.0																																
45 to 512	2.5	5.0	.0																																
821 to 896	1.5	2.5	2.5																																
928 to 29.	5.0	N/A	N/A																																
929 to 960.	1.5	N/A	N/A																																
2110 to 2220	10.0	N/A	N/A																																

Test setup	
------------	--

Procedure	A communication link was established between EUT and base station. The frequency error was monitored and measured by base station under variation of ambient temperature and variation of primary supply voltage. Limit: The frequency stability of the transmitter shall be maintained within
-----------	--

	±0.00025% (±2.5ppm) of the center frequency.
Remark	
Result	☒ Pass ☐ Fail

Test Data ☒ Yes ☐ N/A
 Test Plot ☐ Yes (See below) ☒ N/A

Cellular Band (Part 22H) result

Middle Channel, $f_0 = 836.6$ MHz				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	18	0.0215	2.5
0		17	0.0203	2.5
10		19	0.0227	2.5
20		20	0.0239	2.5
30		15	0.0179	2.5
40		16	0.0191	2.5
50		13	0.0155	2.5
55		28	0.0335	2.5
25	4.2	26	0.0311	2.5
	3.5	28	0.0335	2.5

PCS Band (Part 24E) result

Middle Channel, $f_0 = 1880$ MHz				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	25	0.0133	2.5
0		23	0.0122	2.5
10		21	0.0112	2.5
20		22	0.0117	2.5
30		18	0.0096	2.5
40		16	0.0085	2.5
50		15	0.0080	2.5
55		20	0.0106	2.5
25	4.2	21	0.0112	2.5
	3.5	24	0.0128	2.5

UMTS-FDD Band V (Part 22H)

Middle Channel, $f_0 = 835$ MHz				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	16	0.0192	2.5
0		14	0.0168	2.5
10		11	0.0132	2.5
20		13	0.0156	2.5
30		15	0.0180	2.5
40		16	0.0192	2.5
50		12	0.0144	2.5
55		19	0.0228	2.5
25	4.2	18	0.0216	2.5
	3.5	23	0.0275	2.5

UMTS-FDD Band II (Part 24E)

Middle Channel, $f_0 = 1880$ MHz				
Temperature (°C)	Power Supplied (V _{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	13	0.0069	2.5
0		11	0.0059	2.5
10		10	0.0053	2.5
20		8	0.0043	2.5
30		9	0.0048	2.5
40		7	0.0037	2.5
50		11	0.0059	2.5
55		14	0.0074	2.5
25	4.2	9	0.0048	2.5
	3.5	13	0.0069	2.5

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
RF Conducted Test					
Agilent ESA-E SERIES SPECTRUM ANALYZER	E4407B	MY45108319	09/16/2015	09/15/2016	☒
Power Splitter	1#	1#	09/01/2015	08/31/2016	☒
Universal Radio Communication Tester	CMU200	121393	09/25/2015	09/24/2016	☒
Temperature/Humidity Chamber	UHL-270	001	10/09/2015	10/08/2016	☒
DC Power Supply	E3640A	MY40004013	09/17/2015	09/16/2016	☒
Radiated Emissions					
EMI test receiver	ESL6	100262	09/17/2015	09/16/2016	☒
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	09/01/2015	08/31/2016	☒
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/25/2015	03/24/2016	☒
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/21/2015	09/20/2016	☒
Bilog Antenna (30MHz~2GHz)	JB1	A112017	09/21/2015	09/20/2016	☒
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71259	09/24/2015	09/23/2016	☒
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/24/2015	09/23/2016	☒
SYNTHESIZED SIGNAL GENERATOR	8665B	3744A01293	09/17/2015	09/16/2016	☒
Tunable Notch Filter	3NF-800/1000-S	AA4	09/01/2015	08/31/2016	☒
Tunable Notch Filter	3NF-1000/2000-S	AM 4	09/01/2015	08/31/2016	☒
Power Amplifier	SMC150D	R1553-0313	03/09/2016	03/08/2017	☒
Power Amplifier	S41-25D	R1553-0314	05/28/2015	05/27/2016	☒

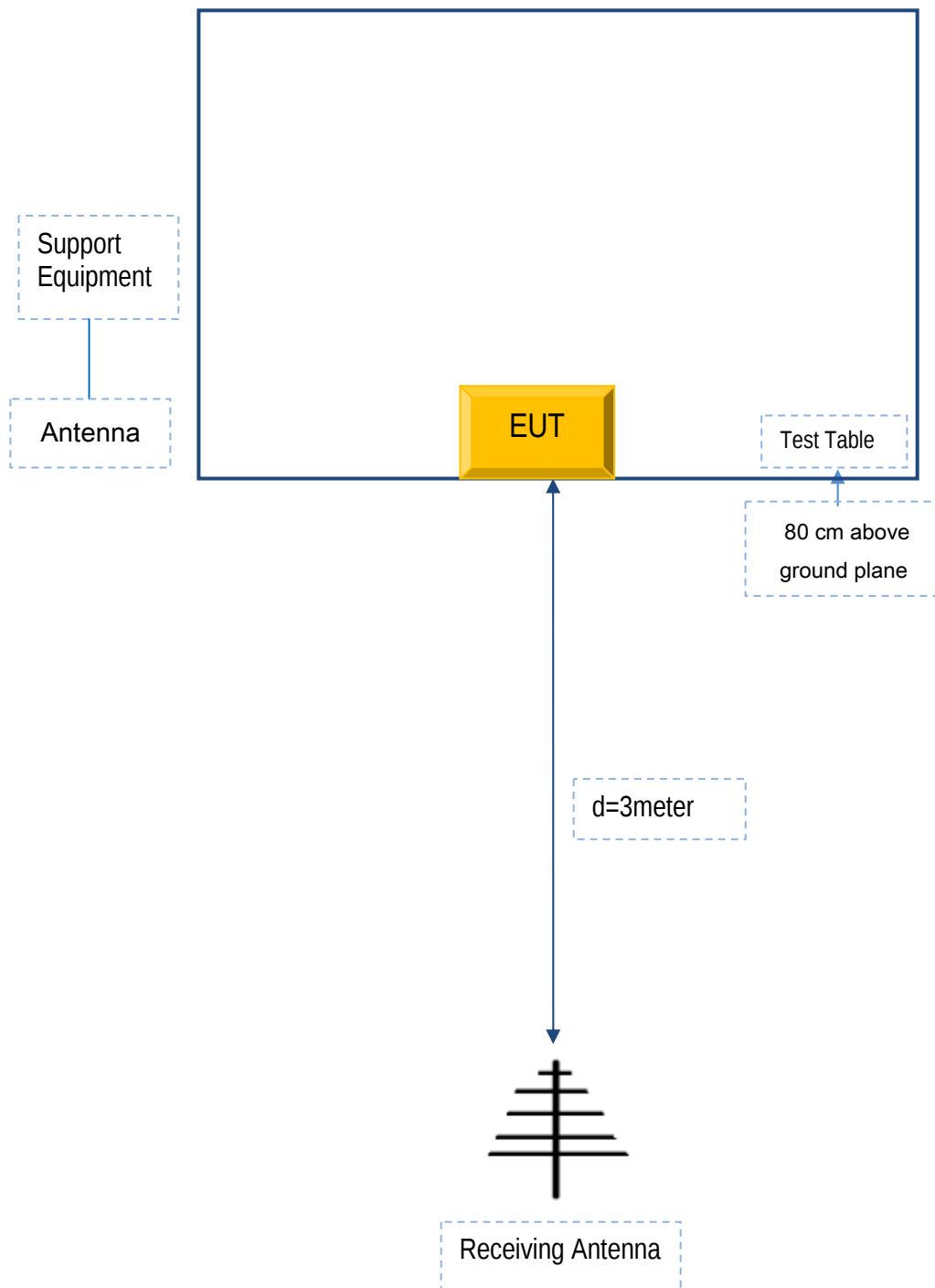
Annex B. Test Setup Photographs



Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.ii. TEST SET UP BLOCK

Block Configuration Diagram for Radiated Emissions



Annex C. ii. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

Supporting Equipment:

Manufacturer	Equipment Description	Model	Serial No
N/A	N/A	N/A	N/A

Supporting Cable:

Cable type	Shield Type	Ferrite Core	Length	Serial No
N/A	N/A	N/A	N/A	N/A