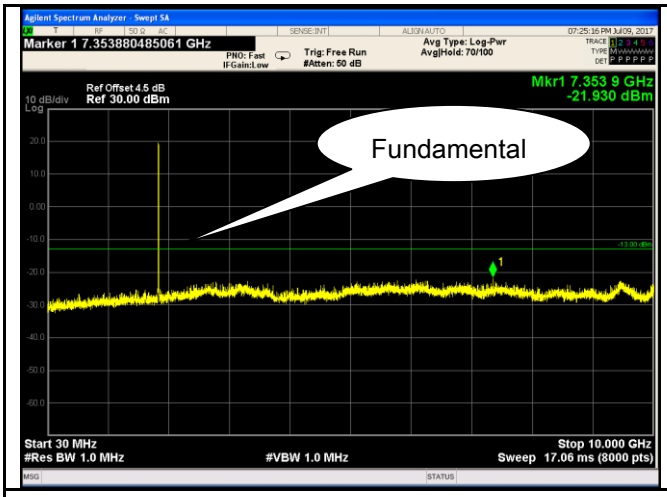
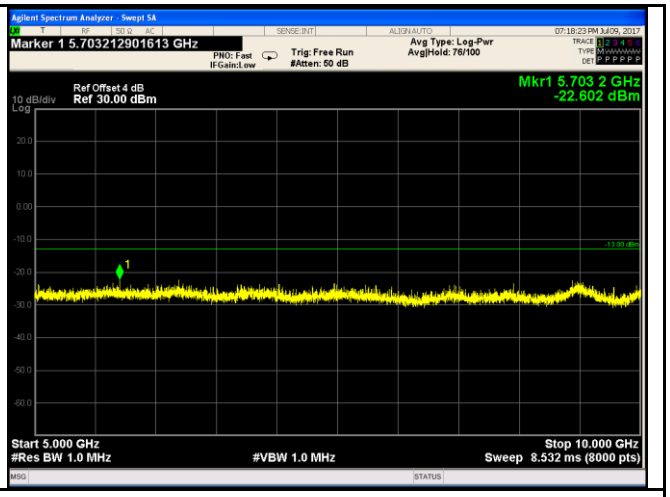
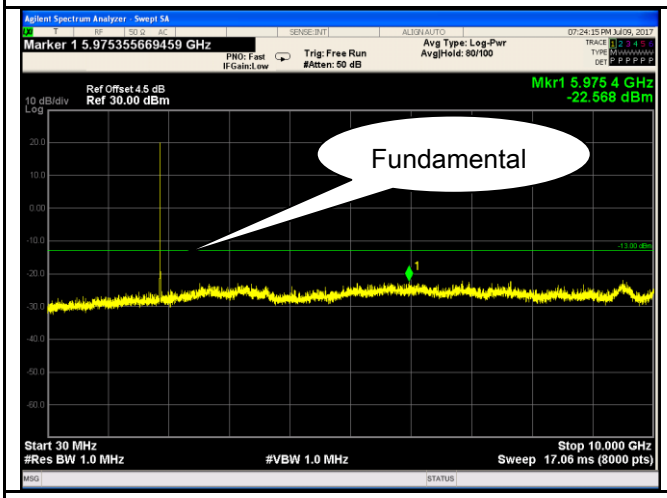
UMTS-FDD Band II (Part 24E)



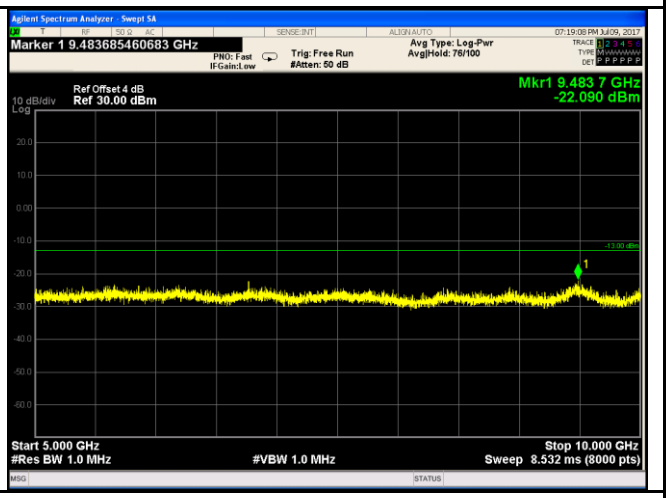
Band II - Low Channel-1



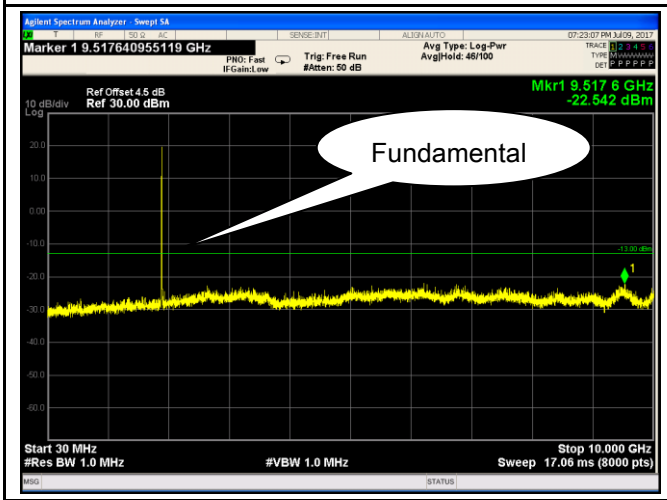
Band II - Low Channel-2



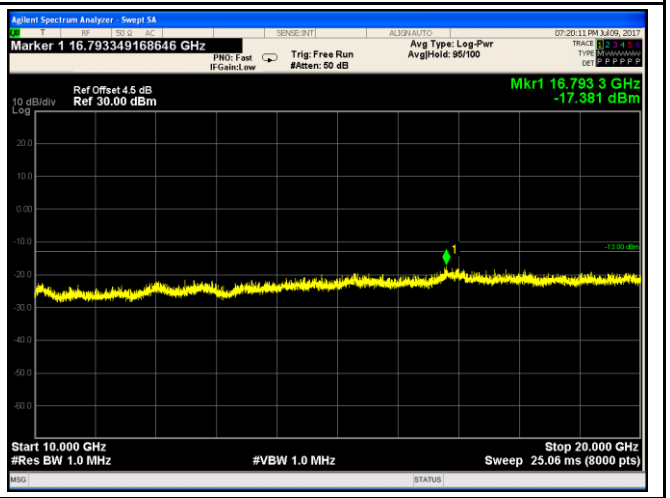
Band II - Middle Channel-1



Band II - Middle Channel-2



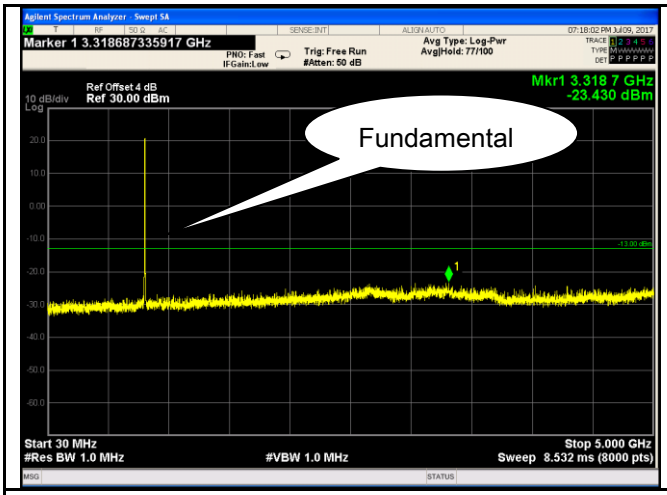
Band II - High Channel-1



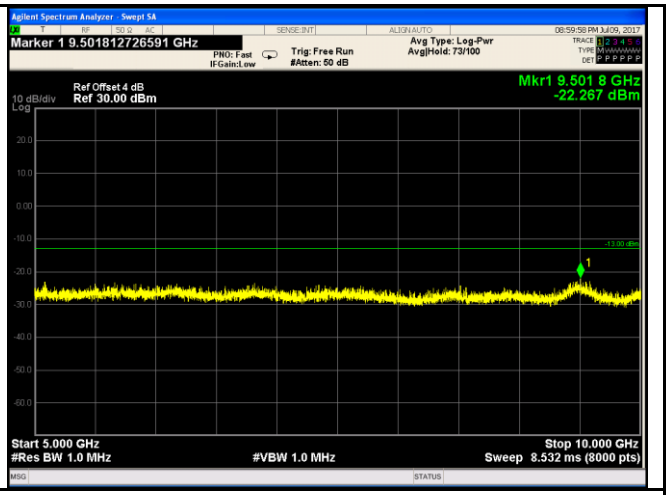
Band II - High Channel-2

HSDPA:

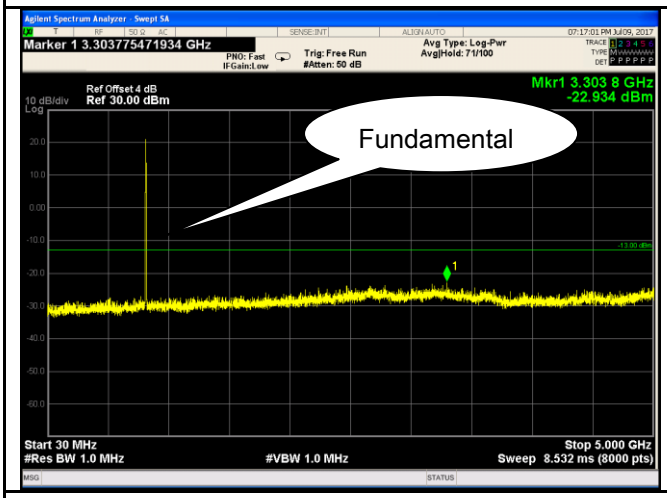
UMTS-FDD Band V (Part 22H)



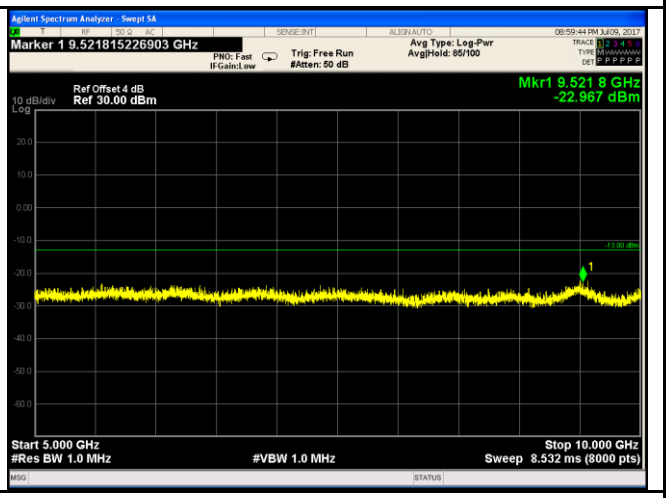
Band V - Low Channel-1



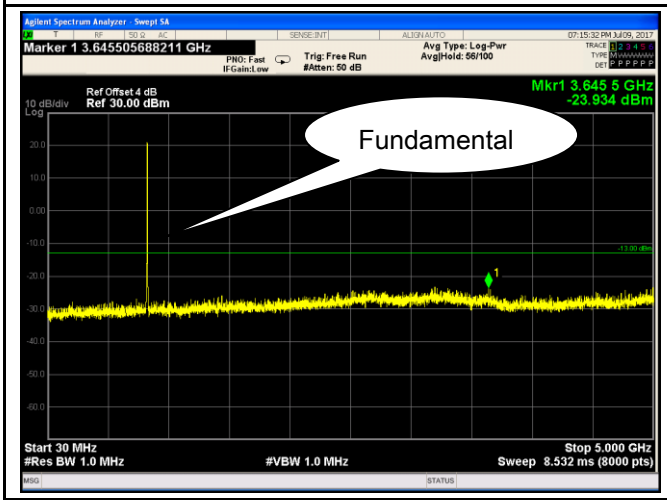
Band V - Low Channel-2



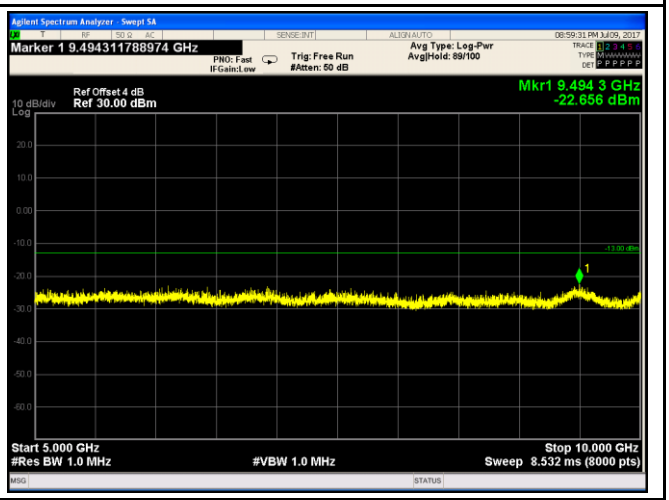
Band V - Middle Channel-1



Band V - Middle Channel-2

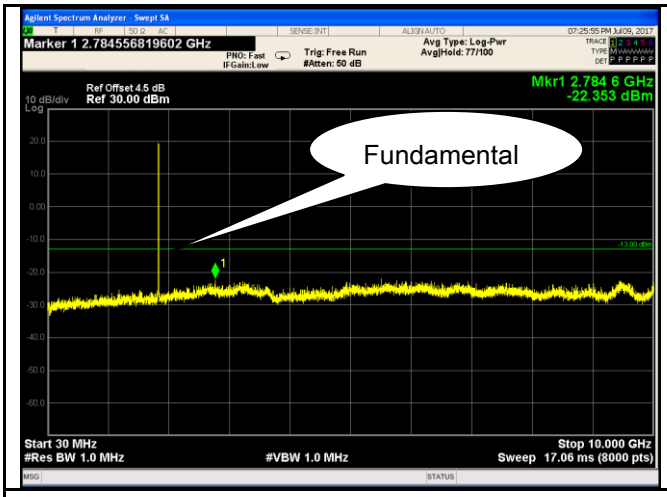


Band V - High Channel-1

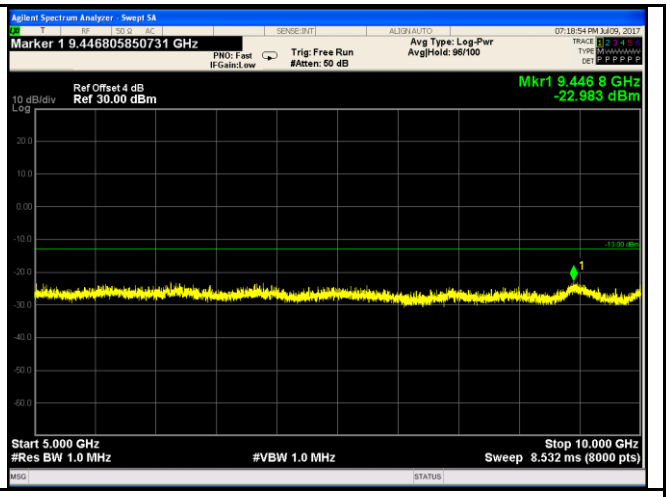


Band V - High Channel-2

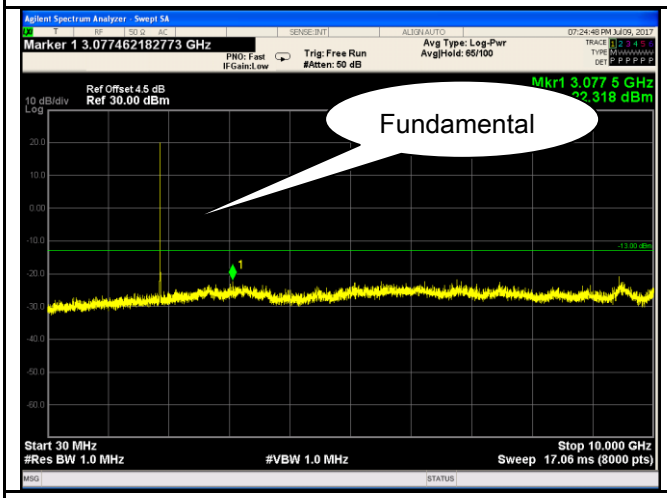
UMTS-FDD Band II (Part 24E)



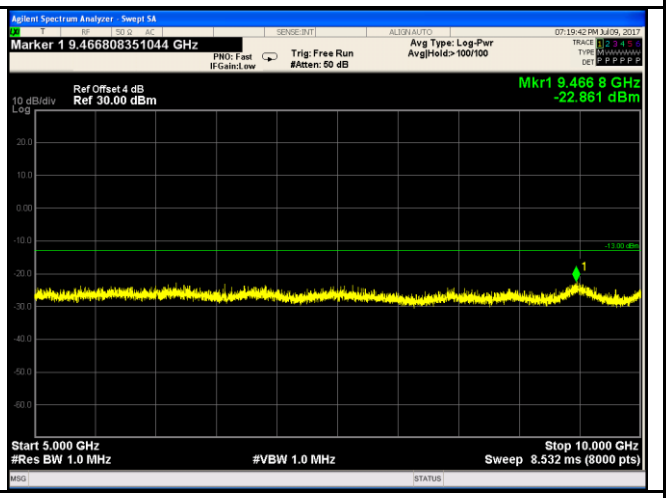
Band II - Low Channel-1



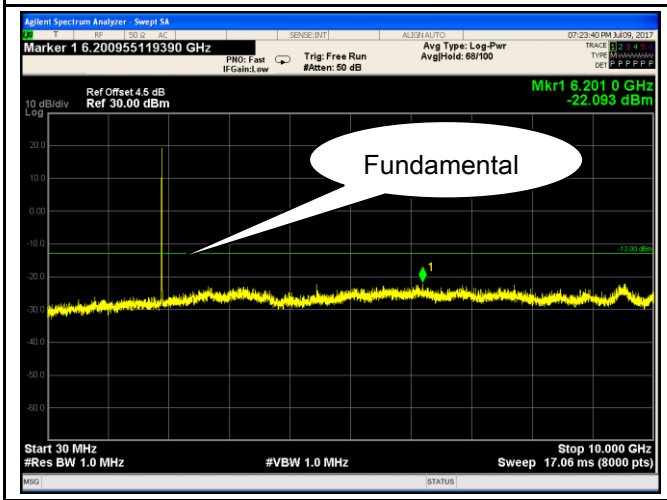
Band II - Low Channel-2



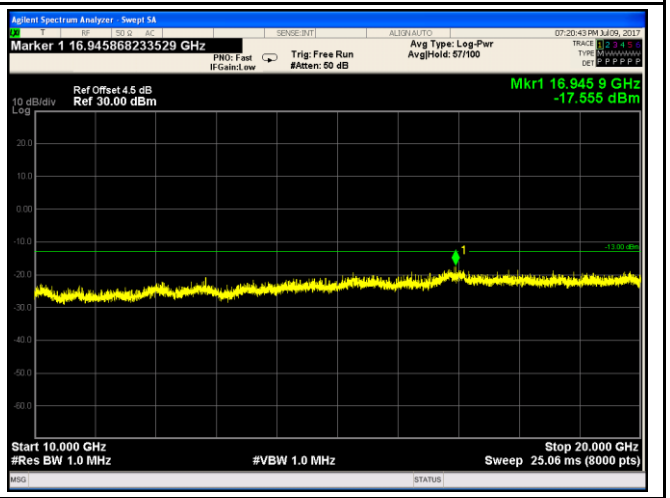
Band II - Middle Channel-1



Band II - Middle Channel-2



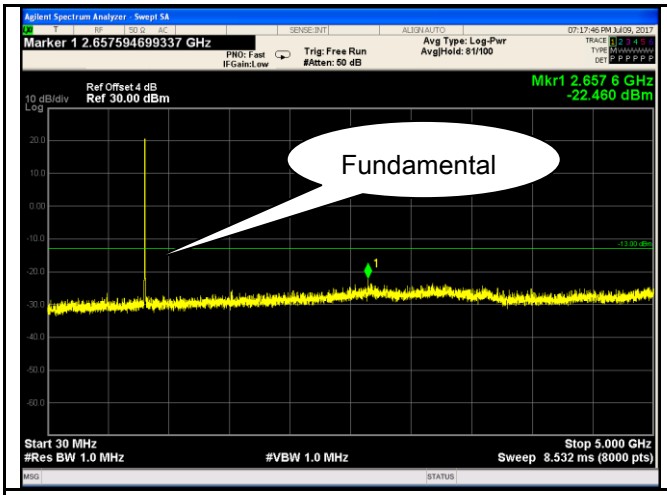
Band II - High Channel-1



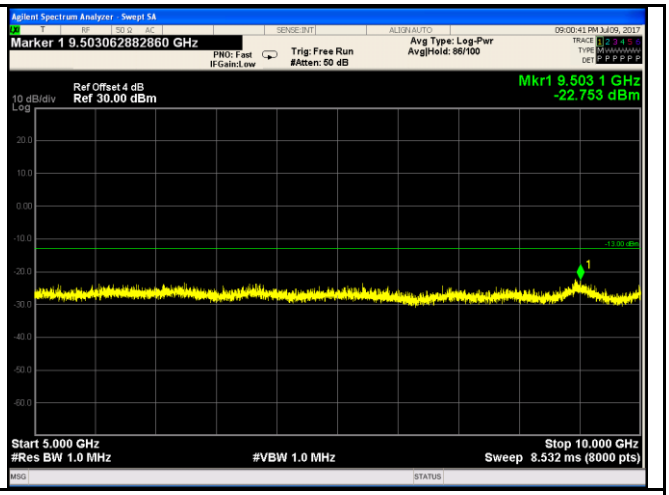
Band II - High Channel-2

HSUPA:

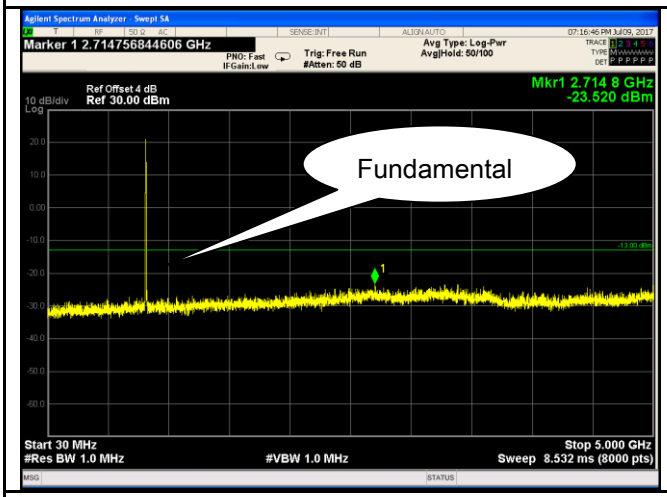
UMTS-FDD Band V (Part 22H)



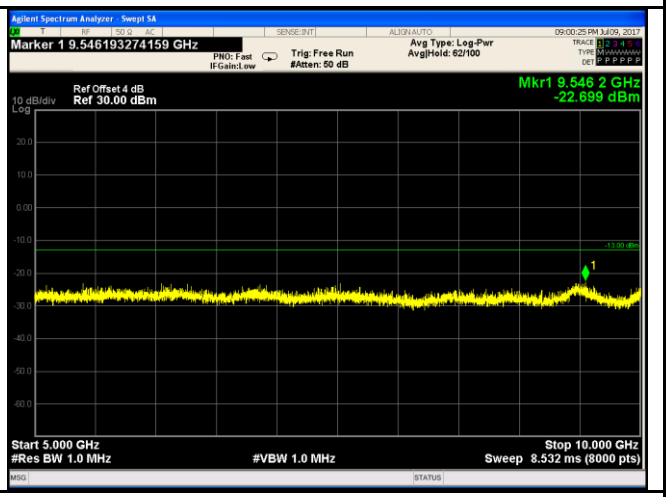
Band V - Low Channel-1



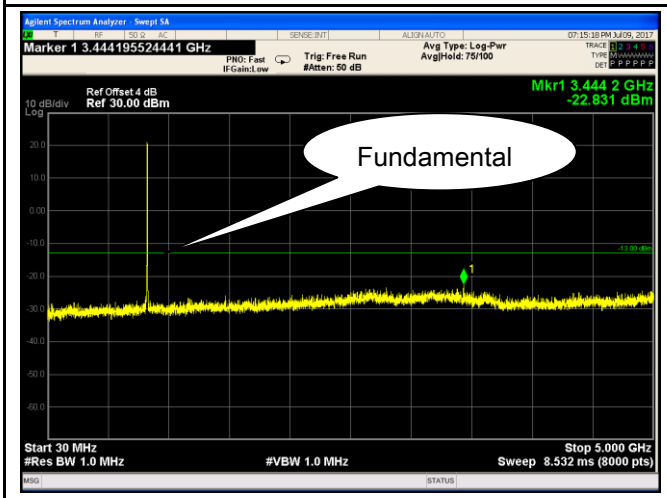
Band V - Low Channel-2



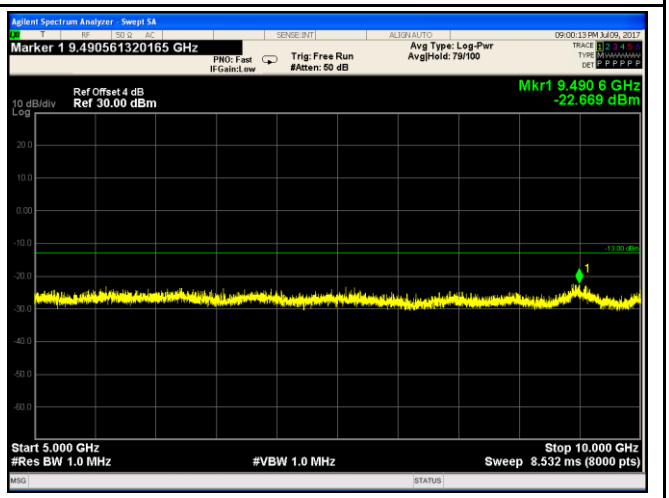
Band V - Middle Channel-1



Band V - Middle Channel-2

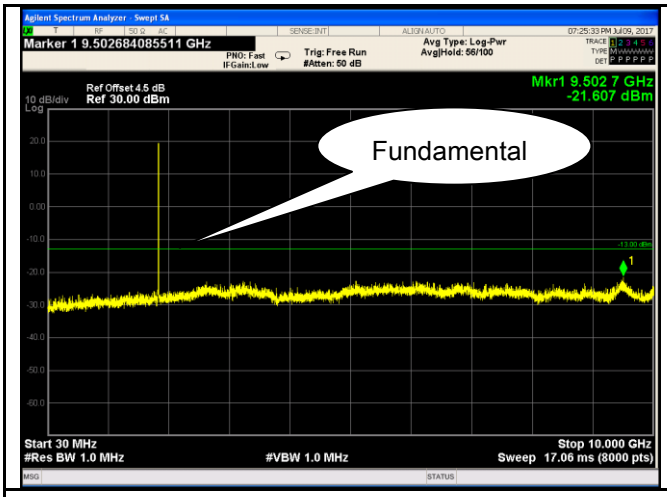


Band V - High Channel-1

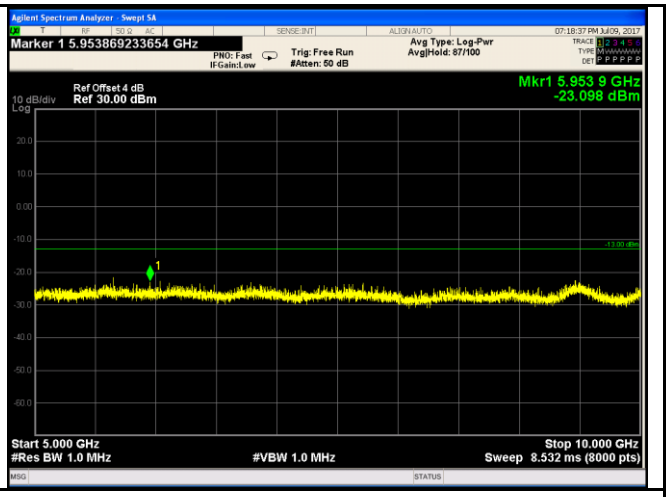


Band V - High Channel-2

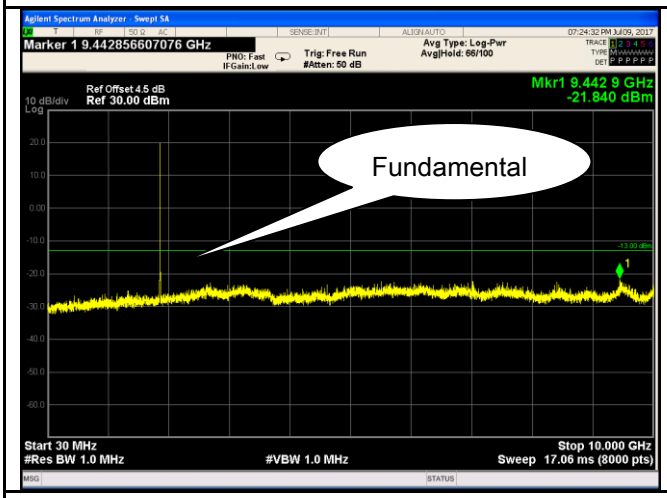
UMTS-FDD Band II (Part 24E)



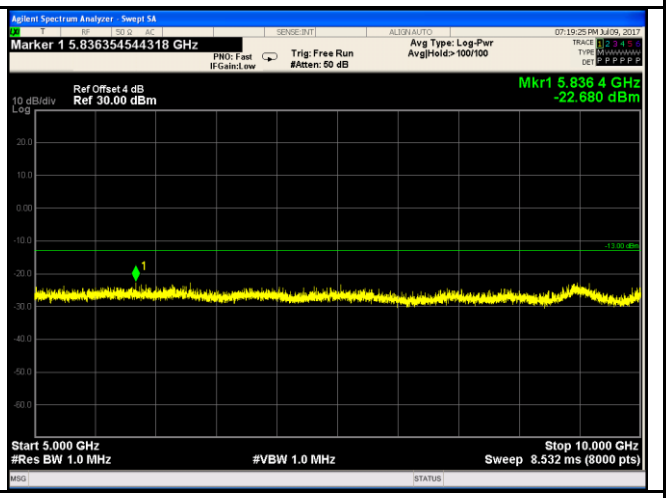
Band II - Low Channel-1



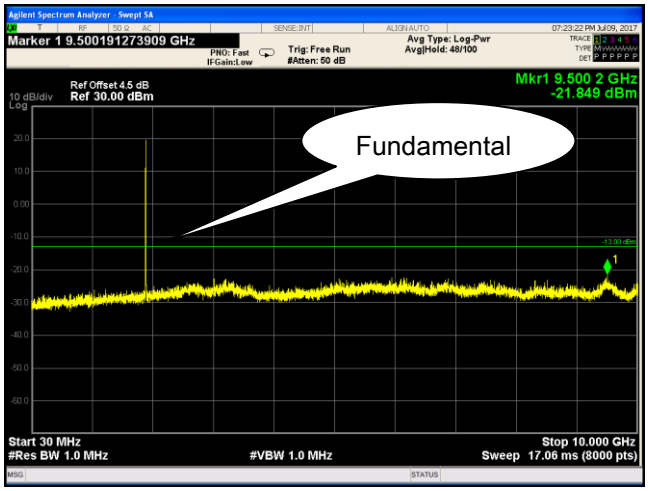
Band II - Low Channel-2



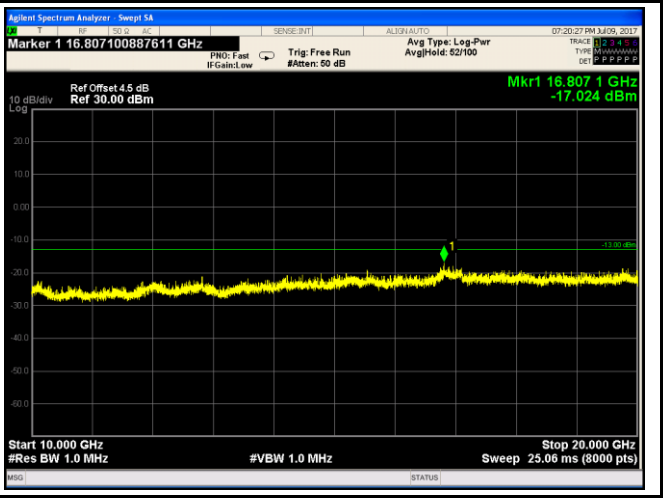
Band II - Middle Channel-1



Band II - Middle Channel-2



Band II - High Channel-1

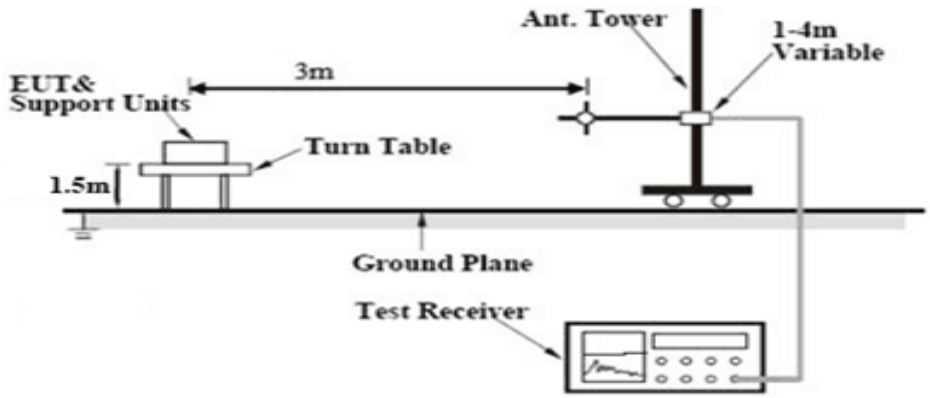


Band II - High Channel-2

6.6 Spurious Radiated Emissions

Temperature	25 °C
Relative Humidity	55%
Atmospheric Pressure	1012mbar
Test date :	July 10, 2017
Tested By :	Loren Luo

Requirement(s):

Spec	Item	Requirement	Applicable
§2.1053, §22.917 & §24.238	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	1. The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable. 2. 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. 3. 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	-42.63	V	7.95	0.67	-35.35	-13	-22.35
1648.4	-44.05	H	7.95	0.67	-36.77	-13	-23.77
704.9	-52.57	V	6.3	0.4	-46.67	-13	-33.67
602.7	-52.26	H	6.8	0.37	-45.83	-13	-32.83

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	-41.91	V	7.95	0.67	-34.63	-13	-21.63
1673.2	-44.09	H	7.95	0.67	-36.81	-13	-23.81
330.7	-53.72	V	6.4	0.26	-47.58	-13	-34.58
611.9	-53.55	H	6.8	0.37	-47.12	-13	-34.12

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	-42.36	V	7.95	0.68	-35.09	-13	-22.09
1697.6	-44.05	H	7.95	0.68	-36.78	-13	-23.78
457.8	-51.02	V	6	0.29	-45.31	-13	-32.31
924.2	-53.36	H	6.2	0.44	-47.6	-13	-34.6

Note:

*1, The testing has been conformed to 10*848.8MHz=8,488MHz*
2, All other emissions more than 30 dB below the limit
3,GSM voice , GPRS and EGPRS mode were investigated. The results above show only the worse cases
4, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

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	-49.21	V	10.25	1	-39.96	-13	-26.96
3700.4	-49.9	H	10.25	1	-40.65	-13	-27.65
83.1	-53.4	V	0.4	0.12	-53.12	-13	-40.12
600.6	-53.44	H	6.8	0.37	-47.01	-13	-34.01

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	-47.26	V	10.25	1.01	-38.02	-13	-25.02
3760	-50.41	H	10.25	1.01	-41.17	-13	-28.17
329.4	-53.4	V	6.4	0.26	-47.26	-13	-34.26
603.3	-52.99	H	6.8	0.37	-46.56	-13	-33.56

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	V	10.36	1.02	-39.66	-13	-26.66
3819.6	-47.92	H	10.36	1.02	-38.58	-13	-25.58
751.5	-54.71	V	6.4	0.43	-48.74	-13	-35.74
924.5	-51.24	H	6.2	0.44	-45.48	-13	-32.48

Note:

*1, The testing has been conformed to 10*1909.8MHz=19,098MHz*
2, All other emissions more than 30 dB below the limit
3,GSM voice , GPRS and EGPRS mode were investigated. The results above show only the worse cases
4, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

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	-46.49	V	7.95	0.67	-39.21	-13	-26.21
1652.8	-46.56	H	7.95	0.67	-39.28	-13	-26.28
323.9	-51.3	V	6.4	0.26	-45.16	-13	-32.16
599.5	-53.15	H	6.8	0.37	-46.72	-13	-33.72

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	-45.1	V	7.95	0.67	-37.82	-13	-24.82
1670	-47.23	H	7.95	0.67	-39.95	-13	-26.95
785.6	-51.57	V	6.2	0.44	-45.81	-13	-32.81
325.1	-53.37	H	6.4	0.26	-47.23	-13	-34.23

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	-48.29	V	7.95	0.68	-41.02	-13	-28.02
1693.2	-46.92	H	7.95	0.68	-39.65	-13	-26.65
325.6	-53.64	V	6.4	0.26	-47.5	-13	-34.5
601.5	-51.59	H	6.8	0.37	-45.16	-13	-32.16

Note:

*1, The testing has been conformed to 10*846.6MHz=8,466MHz*
2, All other emissions more than 30 dB below the limit
3,RMC , HSUPA and HSDPA mode were investigated. The results above show only the worse cases
4, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

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	-49.7	V	10.25	1	-40.45	-13	-27.45
3704.8	-49.3	H	10.25	1	-40.05	-13	-27.05
328.7	-53.27	V	6.4	0.26	-47.13	-13	-34.13
606.1	-54	H	6.8	0.37	-47.57	-13	-34.57

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	-50.1	V	10.25	1.01	-40.86	-13	-27.86
3760	-50.57	H	10.25	1.01	-41.33	-13	-28.33
507.9	-52.64	V	6.1	0.34	-46.88	-13	-33.88
606.2	-52.68	H	6.8	0.37	-46.25	-13	-33.25

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	-48.92	V	10.36	1.02	-39.58	-13	-26.58
3815.2	-49.84	H	10.36	1.02	-40.5	-13	-27.5
214.4	-54.96	V	3.7	0.18	-51.44	-13	-38.44
865.2	-53.07	H	6.2	0.44	-47.31	-13	-34.31

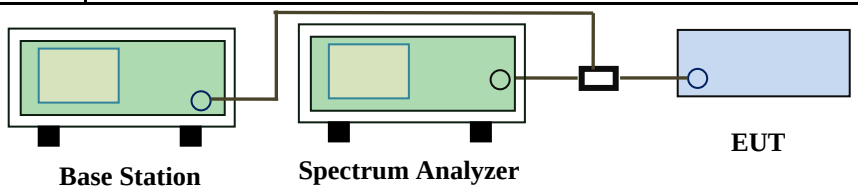
Note:

*1, The testing has been conformed to 10*1907.6MHz=19,076MHz*
2, All other emissions more than 30 dB below the limit
3,RMC , HSUPA and HSDPA mode were investigated. The results above show only the worse cases
4, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case

6.7 Band Edge

Temperature	25 °C
Relative Humidity	56%
Atmospheric Pressure	1018mbar
Test date :	July 09, 2017
Tested By :	Loren Luo

Requirement(s):

Spec	Item	Requirement	Applicable
§22.917(a) §24.238(a)	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

GSM Voice:

Cellular Band (Part 22H) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.9975	-16.802	-13
849.0025	-15.682	-13

PCS Band (Part24E) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.9975	-19.775	-13
1910.0225	-18.339	-13

GPRS:

Cellular Band (Part 22H) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.9800	-15.398	-13
849.0200	-16.204	-13

PCS Band (Part24E) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.9975	-20.639	-13
1910.0250	-18.569	-13

EGPRS (MCS 5):

Cellular Band (Part 22H) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.9989	-15.148	-13
849.0025	-17.058	-13

PCS Band (Part24E) result

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.9975	-19.452	-13
1910.0200	-19.093	-13

RMC:

UMTS-FDD Band V (Part 22H)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
824.000	-24.835	-13
849.275	-25.409	-13

UMTS-FDD Band II (Part 24E)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.925	-23.496	-13
1910.075	-20.987	-13

HSDPA:

UMTS-FDD Band V (Part 22H)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.550	-25.240	-13
849.200	-25.355	-13

UMTS-FDD Band II (Part 24E)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.900	-24.977	-13
1910.050	-20.438	-13

HSUPA:

UMTS-FDD Band V (Part 22H)

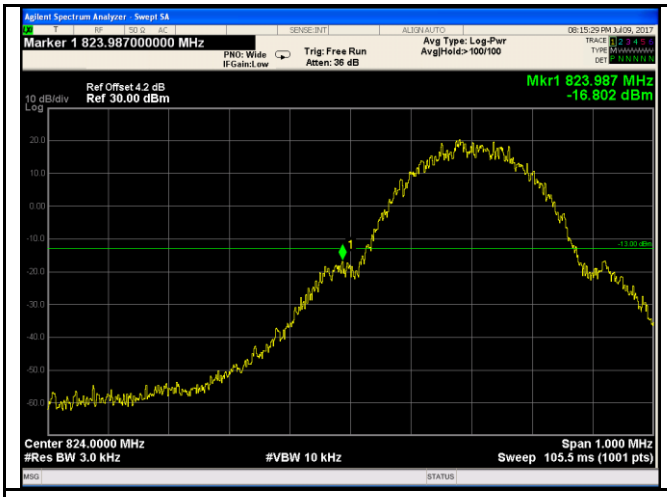
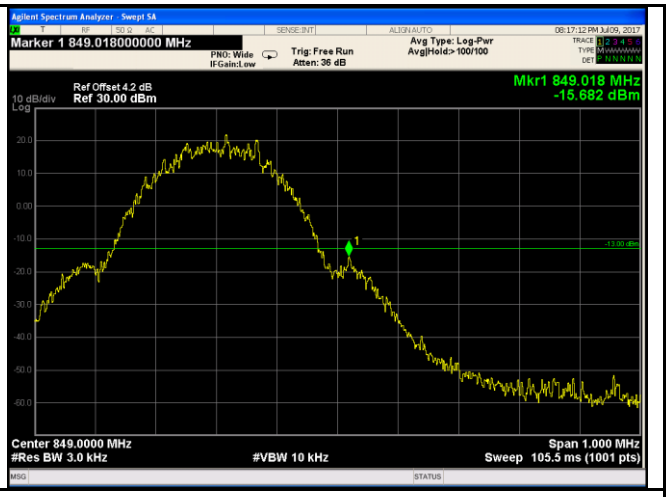
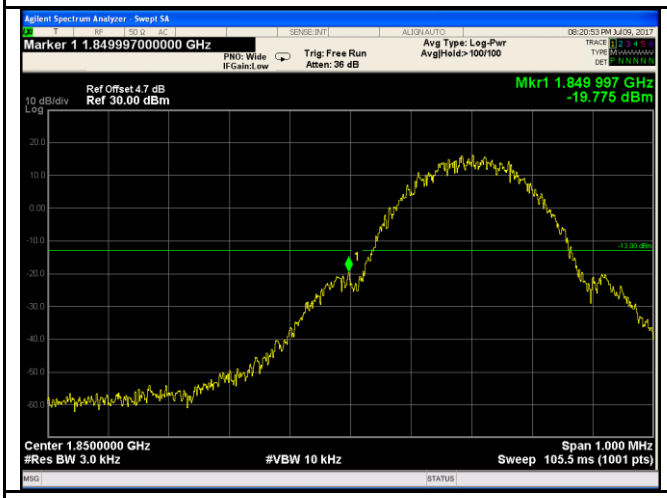
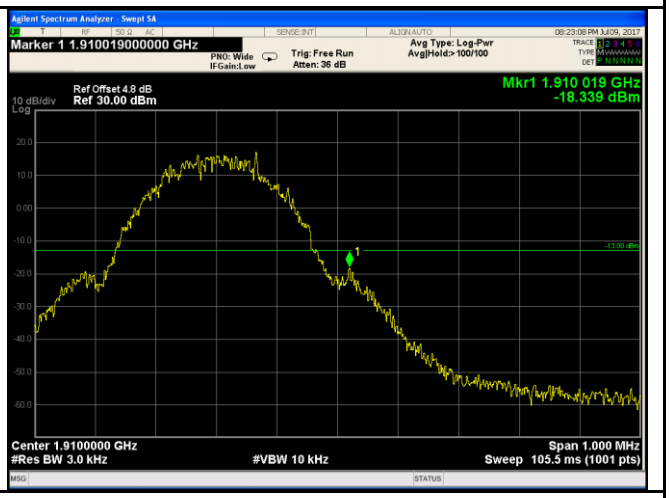
Frequency (MHz)	Emission (dBm)	Limit (dBm)
823.825	-25.188	-13
849.875	-24.957	-13

UMTS-FDD Band II (Part 24E)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1849.925	-23.003	-13
1910.025	-20.661	-13

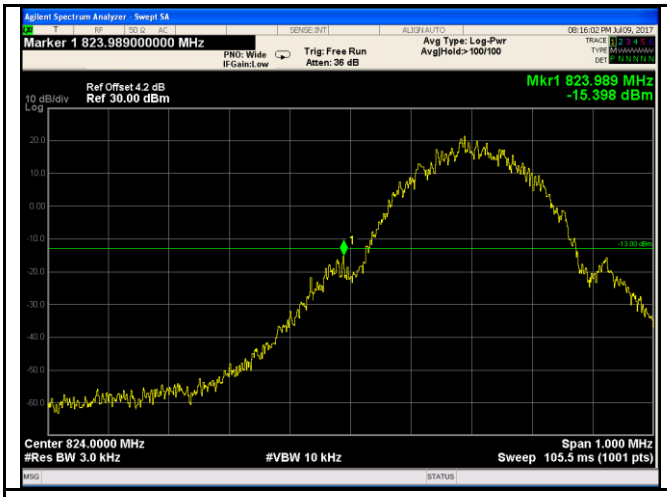
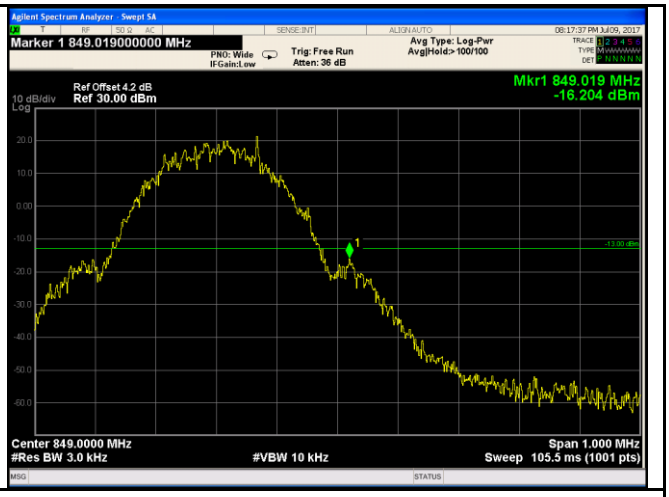
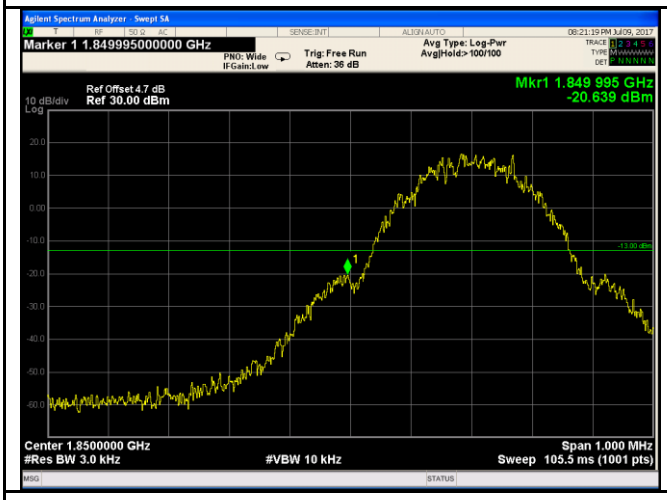
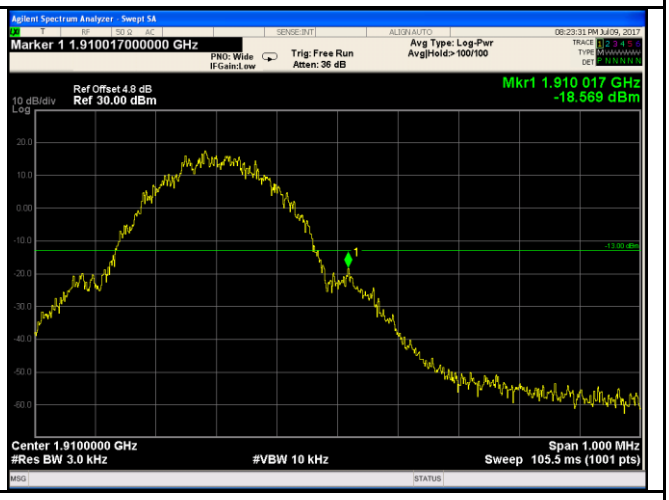
GSM Voice:

Test Plots

	
Cellular Band - Low Channel	Cellular Band - High Channel
Note: Offset=Cable loss (4.0) + 10log (3.16/3)=4.0+0.2=4.2dB	Note: Offset=Cable loss (4.0) + 10log (3.09/3)=4.0+0.2=4.2dB
	
PCS Band - Low Channel	PCS Band - High Channel
Note: Offset=Cable loss (4.0) + 10log (3.17/3)=4.5+0.2=4.7dB	Note: Offset=Cable loss (4.0) + 10log (3.19/3)=4.5+0.3=4.8dB

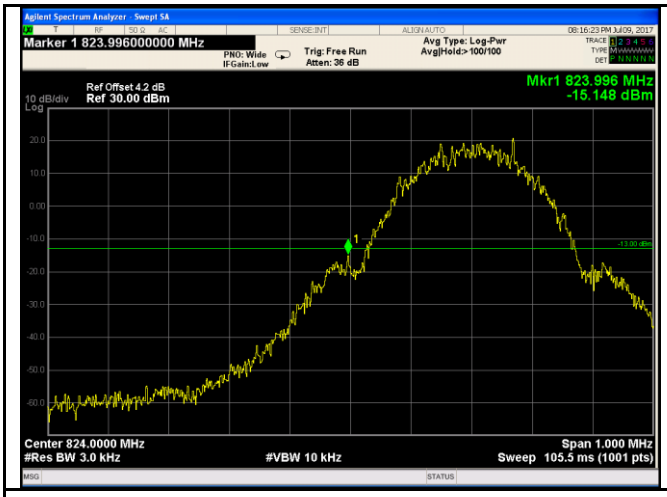
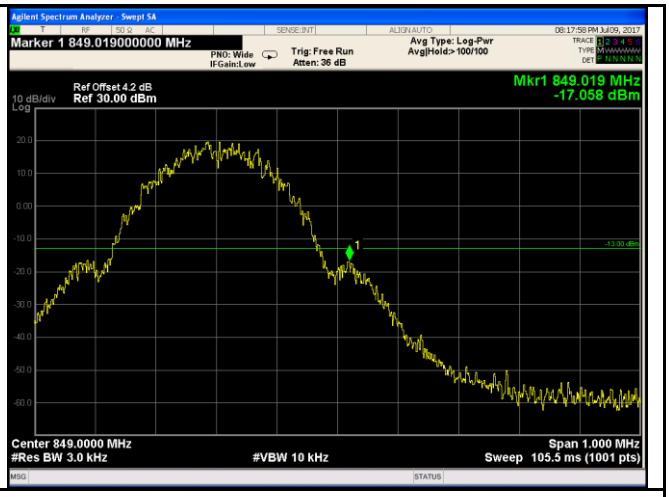
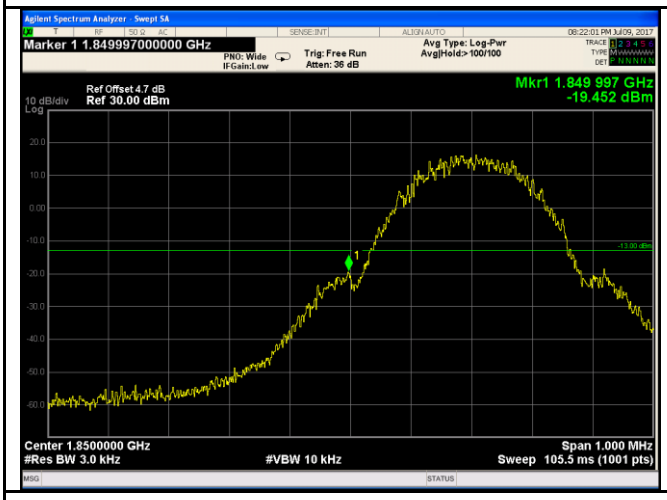
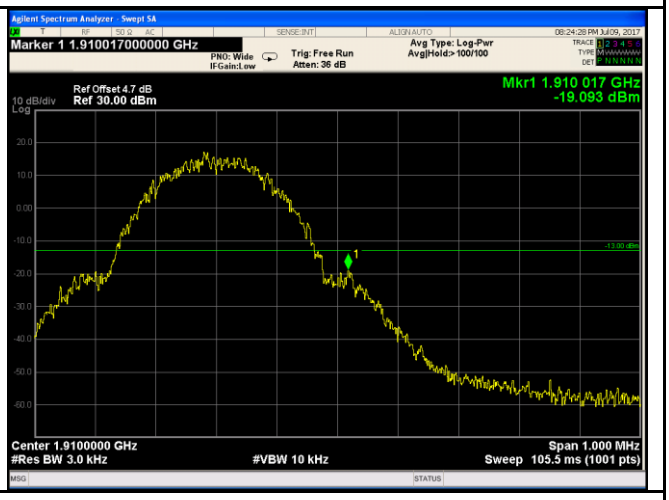
GPRS:

Test Plots

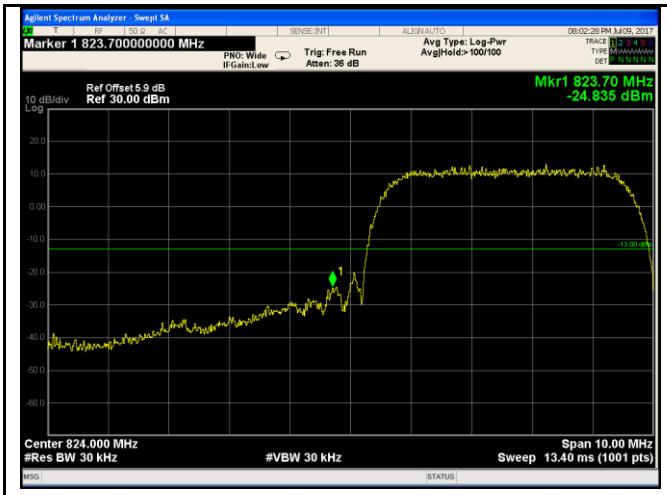
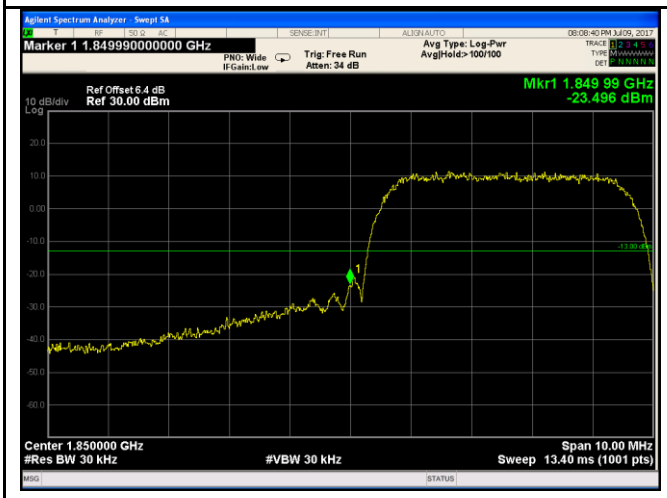
	
Cellular Band - Low Channel	Cellular Band - High Channel
Note: Offset=Cable loss (4.0) + 10log (3.13/3)=4.0+0.2=4.2dB	Note: Offset=Cable loss (4.0) + 10log (3.13/3)=4.0+0.2=4.2dB
	
PCS Band - Low Channel	PCS Band - High Channel
Note: Offset=Cable loss (4.5) + 10log (3.14/3)=4.5+0.2=4.7dB	Note: Offset=Cable loss (4.5) + 10log (3.21/3)=4.5+0.3=4.8dB

EGPRS (MCS 1):

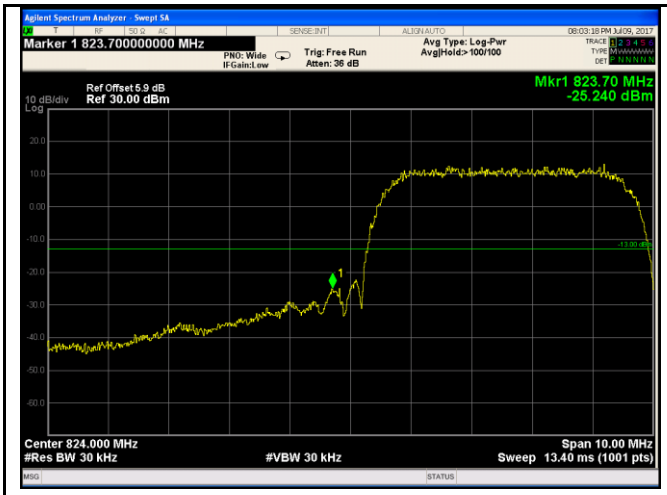
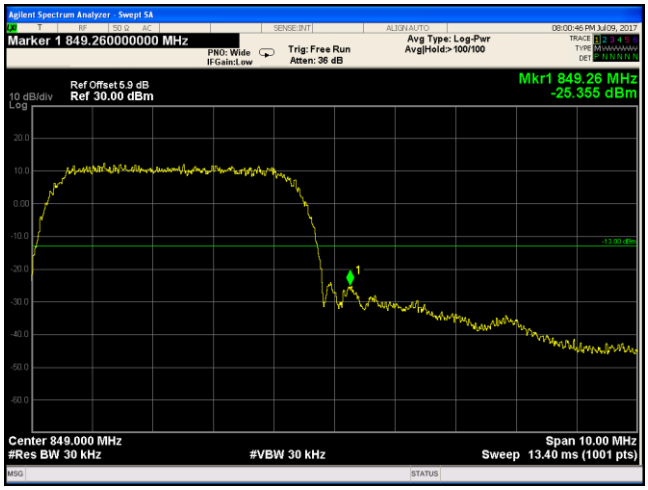
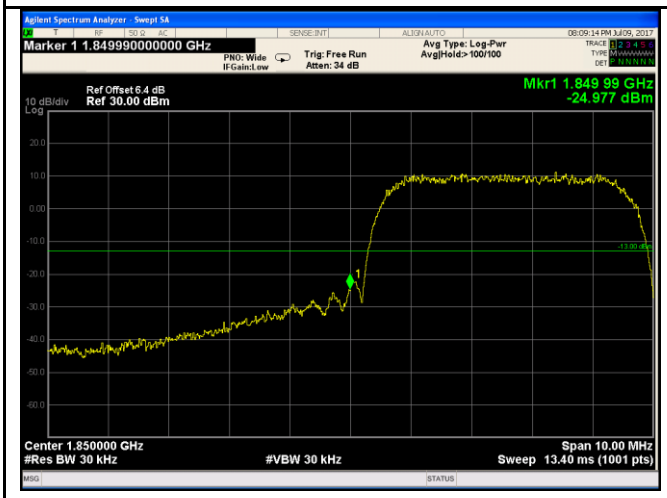
Test Plots

	
Cellular Band - Low Channel	Cellular Band - High Channel
Note: Offset=Cable loss (4.0) + 10log (3.11/3)=4.0+0.2=4.2dB	Note: Offset=Cable loss (4.0) + 10log (3.13/3)=4.0+0.2=4.2dB
	
PCS Band - Low Channel	PCS Band - High Channel
Note: Offset=Cable loss (4.5) + 10log (3.11/3)=4.5+0.2=4.7dB	Note: Offset=Cable loss (4.5) + 10log (3.12/3)=4.5+0.2=4.7dB

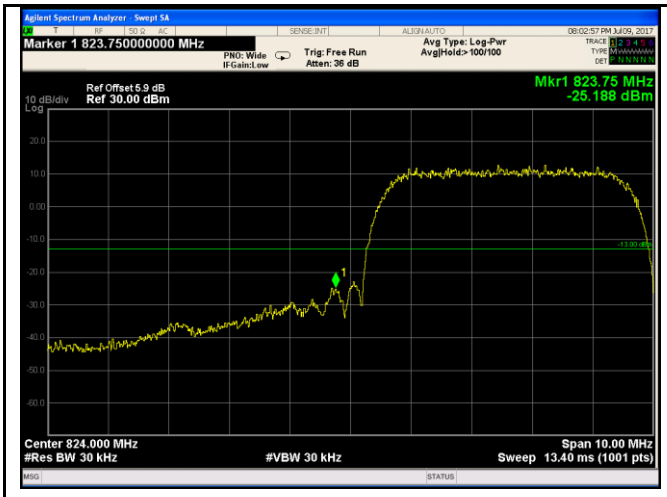
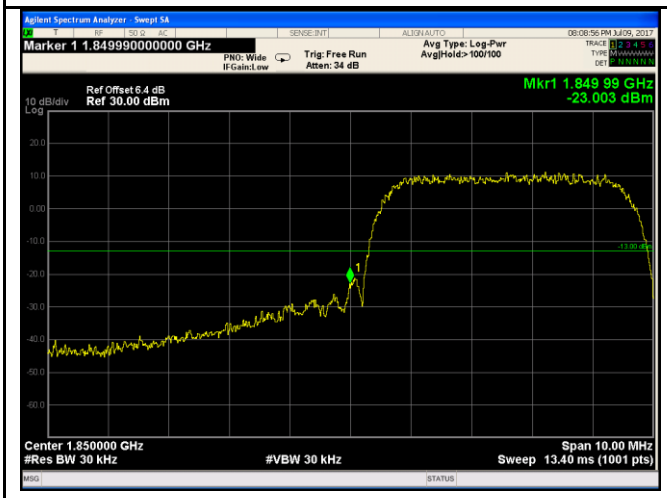
RMC:

	
UMTS-FDD Band V - Low Channel	UMTS-FDD Band V - High Channel
Note: Offset=Cable loss (4.0) + 10log (46.58/30)=4.0+1.9=5.9 dB	Note: Offset=Cable loss (4.0) + 10log (46.65/30)=4.0+1.9=5.9 dB
	
UMTS-FDD Band II - Low Channel	UMTS-FDD Band II - High Channel
Note: Offset=Cable loss (4.5) + 10log (46.56/30)=4.5+1.9=6.4 dB	Note: Offset=Cable loss (4.5) + 10log (47.37/30)=4.5+2.0=6.5 dB

HSDPA:

	
UMTS-FDD Band V - Low Channel	UMTS-FDD Band V - High Channel
Note: Offset=Cable loss (4.0) + 10log (46.70/30)=4.0+1.9=5.9 dB	Note: Offset=Cable loss (4.0) + 10log (46.71/30)=4.0+1.9=5.9 dB
	
UMTS-FDD Band II - Low Channel	UMTS-FDD Band II - High Channel
Note: Offset=Cable loss (4.5) + 10log (46.37/30)=4.5+1.9=6.4 dB	Note: Offset=Cable loss (4.5) + 10log (47.70/30)=4.5+2.0=6.5 dB

HSUPA:

	
UMTS-FDD Band V - Low Channel	UMTS-FDD Band V - High Channel
Note: Offset=Cable loss (4.0) + 10log (46.75/30)=4.0+1.9=5.9 dB	Note: Offset=Cable loss (4.0) + 10log (46.58/30)=4.0+1.9=5.9 dB
	
UMTS-FDD Band II - Low Channel	UMTS-FDD Band II - High Channel
Note: Offset=Cable loss (4.5) + 10log (46.75/30)=4.5+1.9=6.4 dB	Note: Offset=Cable loss (4.5) + 10log (47.40/30)=4.5+2.0=6.5 dB

6.8 Frequency Stability

Temperature	25 °C
Relative Humidity	55%
Atmospheric Pressure	1012mbar
Test date :	July 10, 2017
Tested By :	Loren Luo

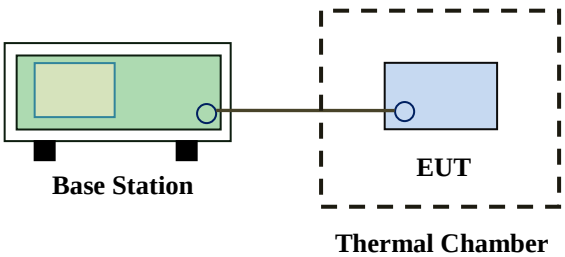
Requirement(s):

Spec	Item	Requirement	Applicable
§2.1055, §22.355 & §24.235	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	☑

Frequency Range (MHz)	Base, fixed (ppm)	Mobile ≤ 3 watts (□□m)	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	50.0
821 to 896	1.5	2.5	2.5
928 to 929	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized frequency block.

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

GSM Voice:

Cellular Band (Part 22H) result

Middle Channel, f_o = 836.6 MHz				
Temperature (℃)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	17	0.0203	2.5
0		18	0.0215	2.5
10		20	0.0239	2.5
20		16	0.0191	2.5
30		14	0.0167	2.5
40		18	0.0215	2.5
50		10	0.0120	2.5
55		16	0.0191	2.5
25	4.2	19	0.0227	2.5
	3.5	15	0.0179	2.5

PCS Band (Part 24E) result

Middle Channel, f_o = 1880 MHz				
Temperature (℃)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	18	0.0096	2.5
0		9	0.0048	2.5
10		12	0.0064	2.5
20		17	0.0090	2.5
30		12	0.0064	2.5
40		17	0.0090	2.5
50		20	0.0106	2.5
55		15	0.0080	2.5
25	4.2	9	0.0048	2.5
	3.5	13	0.0069	2.5

RMC:

UMTS-FDD Band V (Part 22H)

Middle Channel, f_o = 835 MHz				
Temperature (℃)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	14	0.0168	2.5
0		20	0.0240	2.5
10		9	0.0108	2.5
20		12	0.0144	2.5
30		9	0.0108	2.5
40		14	0.0168	2.5
50		20	0.0240	2.5
55		16	0.0192	2.5
25	4.2	17	0.0204	2.5
	3.5	10	0.0120	2.5

UMTS-FDD Band II (Part 24E)

Middle Channel, f_o = 1880 MHz				
Temperature (℃)	Power Supplied (V_{DC})	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-10	3.7	18	0.0096	2.5
0		14	0.0074	2.5
10		14	0.0074	2.5
20		19	0.0101	2.5
30		9	0.0048	2.5
40		20	0.0106	2.5
50		11	0.0059	2.5
55		20	0.0106	2.5
25	4.2	9	0.0048	2.5
	3.5	16	0.0085	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	09/15/2016	09/14/2017	☑
Power Splitter	1#	1#	08/31/2016	08/30/2017	☑
Universal Radio Communication Tester	CMU200	121393	09/24/2016	09/23/2017	☑
Temperature/Humidity Chamber	UHL-270	001	10/08/2016	10/07/2017	☑
DC Power Supply	E3640A	MY40004013	09/16/2016	09/15/2017	☑
RF Power Sensor	Dare RPR3006C/P/W	AY554013	09/16/2016	09/15/2017	☑
Radiated Emissions					
EMI test receiver	ESL6	100262	09/16/2016	09/15/2017	☑
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/31/2016	08/30/2017	☑
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/23/2017	03/22/2018	☑
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/20/2016	09/19/2017	☑
Bilog Antenna (30MHz~2GHz)	JB1	A112017	09/20/2016	09/19/2017	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71259	09/23/2016	09/22/2017	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/23/2016	09/22/2017	☑
SYNTHESIZED SIGNAL GENERATOR	8665B	3744A01293	09/16/2016	09/15/2017	☑
Power Amplifier	SMC150D	R1553-0313	03/08/2017	03/07/2018	☑
Power Amplifier	S41-25D	R1553-0314	05/26/2017	05/25/2018	☑
Tunable Notch Filter	3NF-800/1000-S	AA4	08/31/2016	08/30/2017	☑

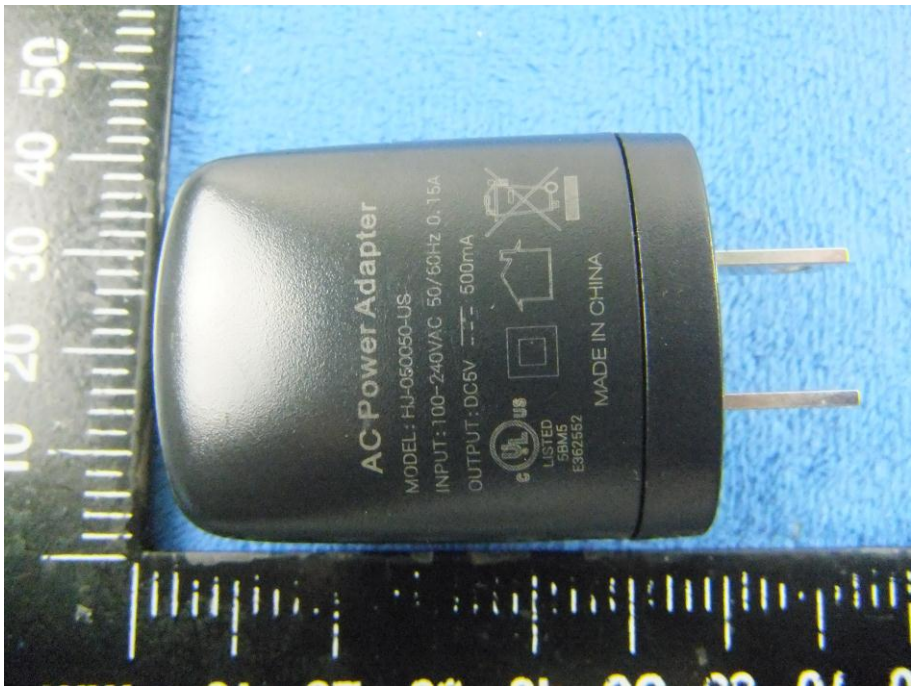
Tunable Notch Filter	3NF-1000/2000-S	AM 4	08/31/2016	08/30/2017	☑

Annex B. EUT And Test Setup Photographs

Annex B.i. Photograph: EUT External Photo

Whole Package View

Adapter - Front View



EUT - Front View

EUT - Rear View

EUT - Top View

EUT - Bottom View

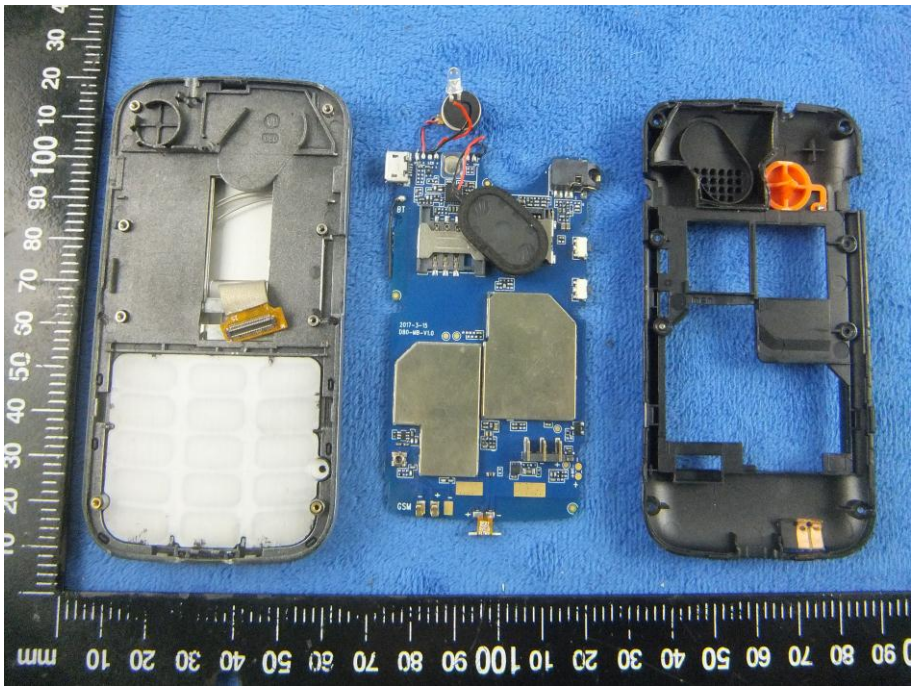
EUT - Left View

EUT - Right View

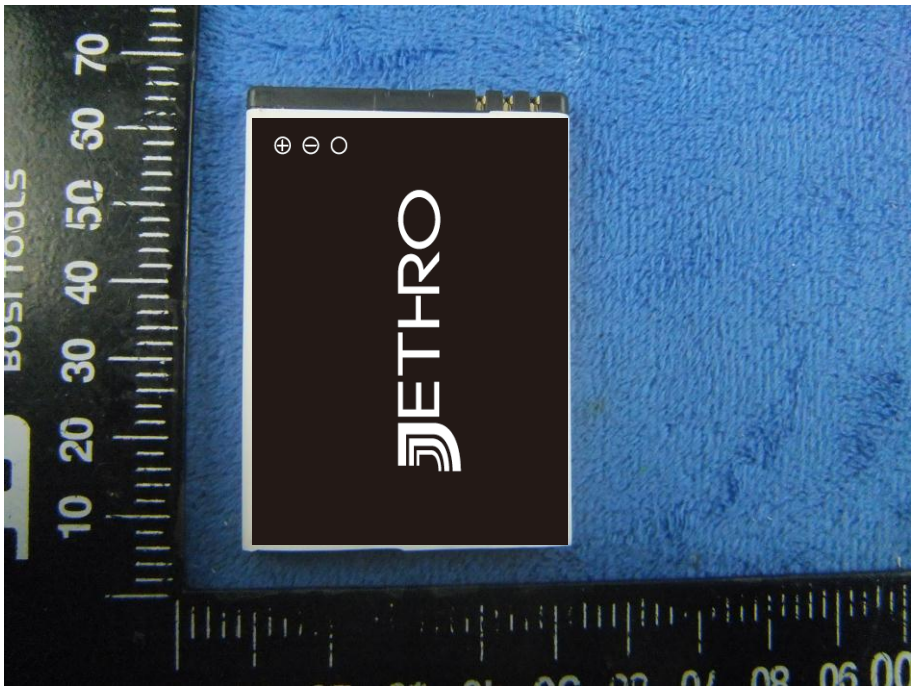
Annex B.ii. Photograph: EUT Internal Photo

Cover Off - Top View 1

Cover Off - Top View 2

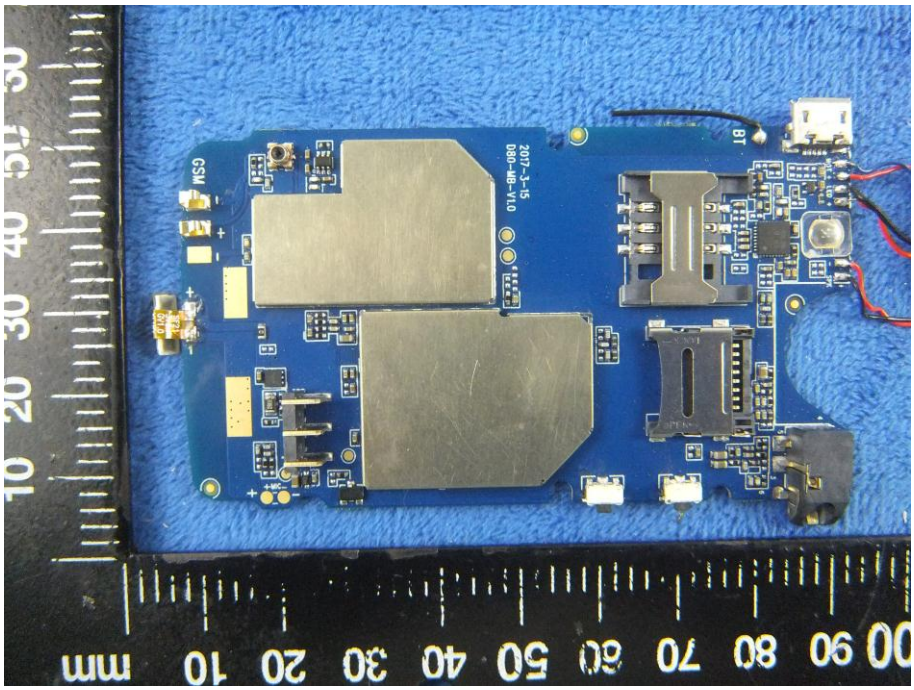


Battery - Front View

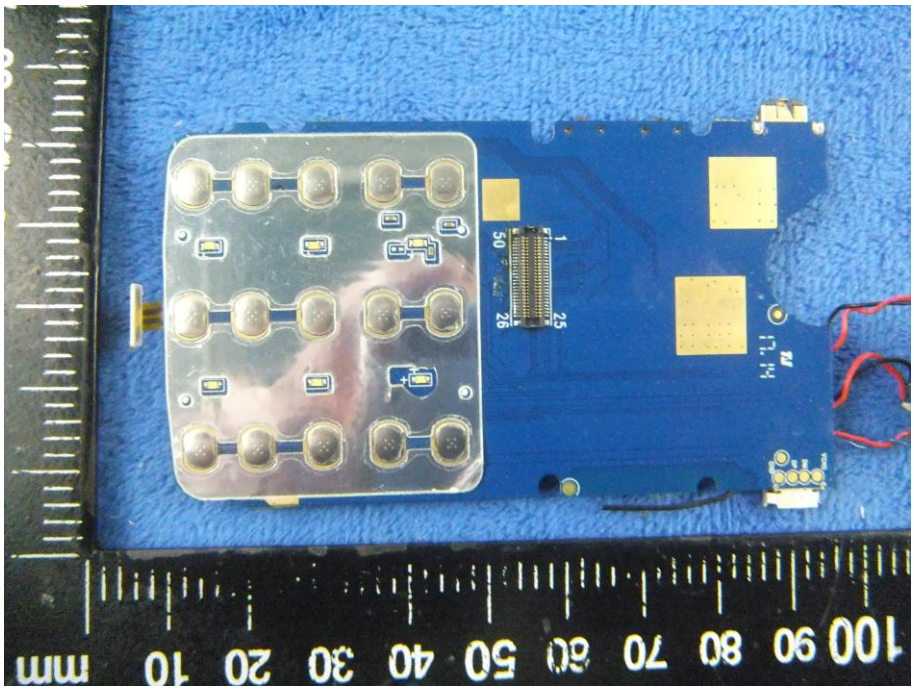


Battery - Rear View

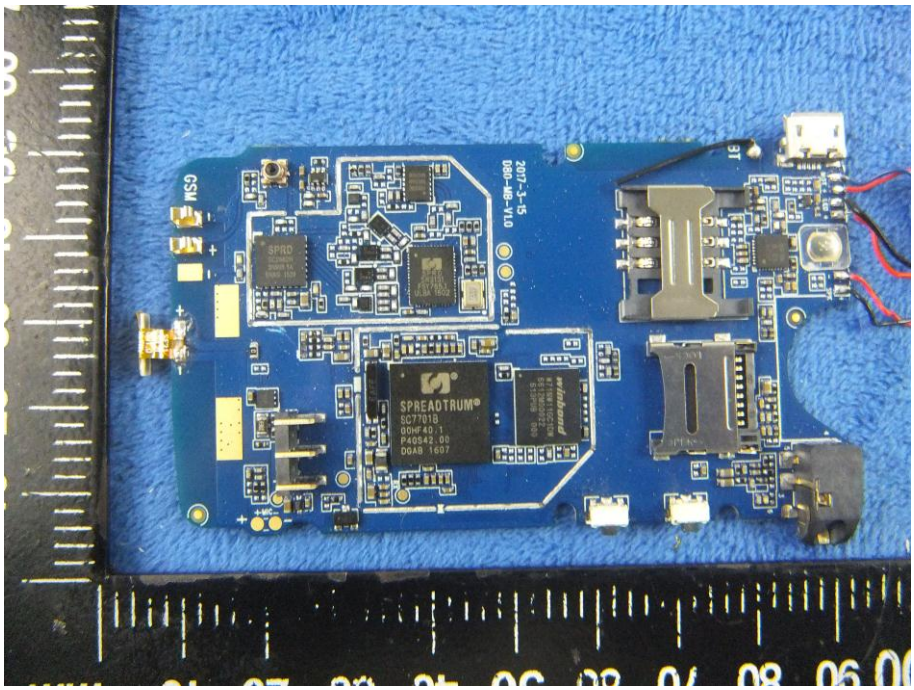
Mainboard with Shielding - Front View



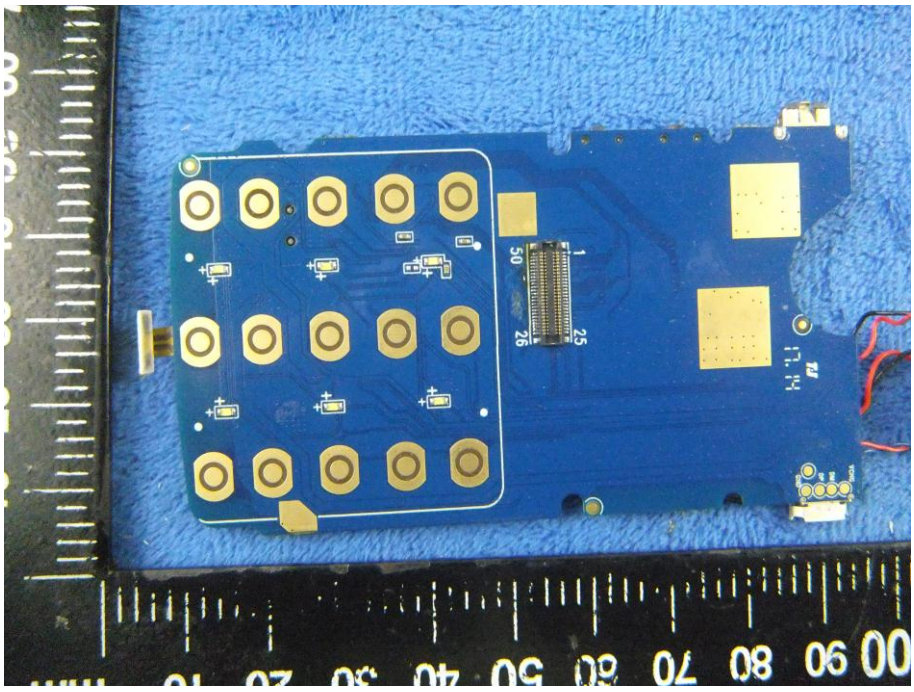
Mainboard with Shielding - Rear View



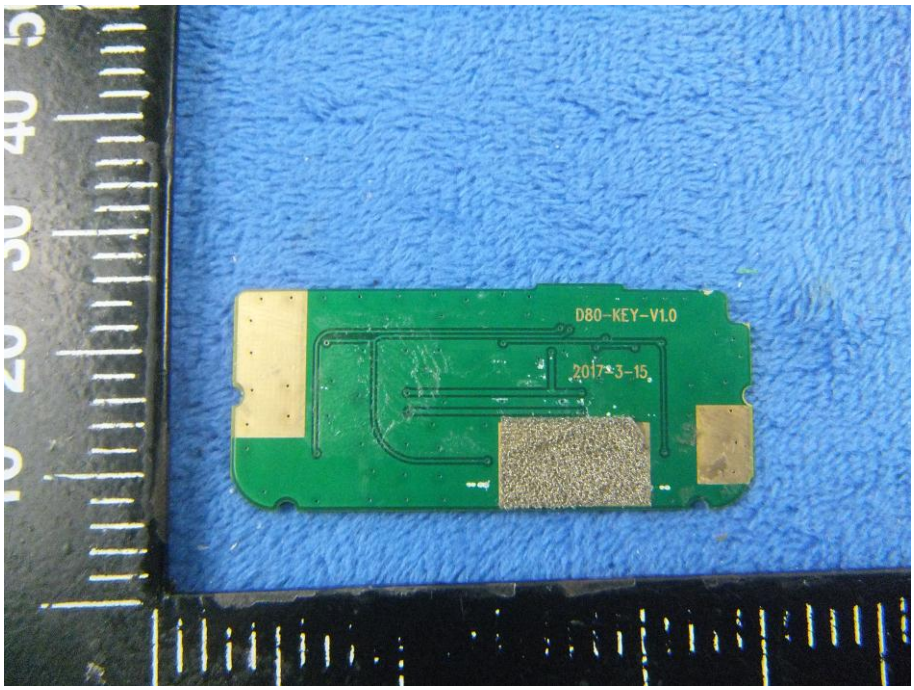
Mainboard without Shielding - Front View



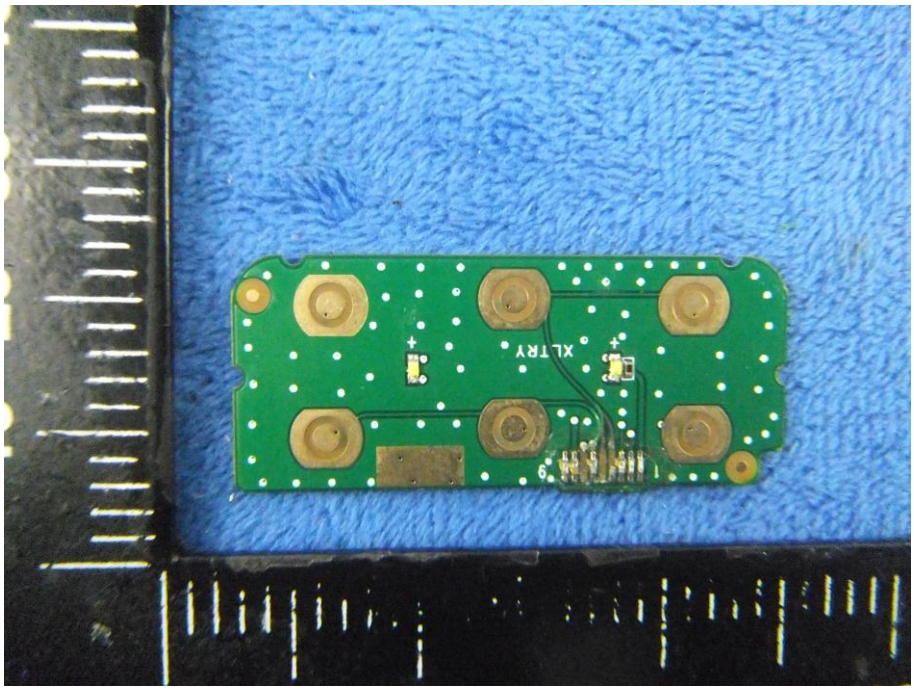
Mainboard without Shielding - Rear View



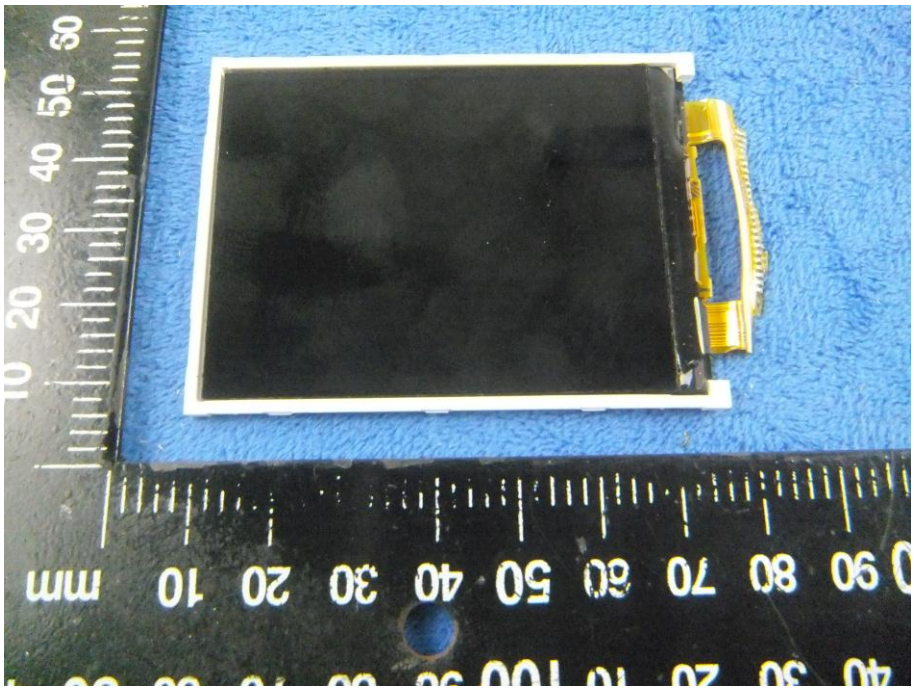
Small Mainboard - Front View



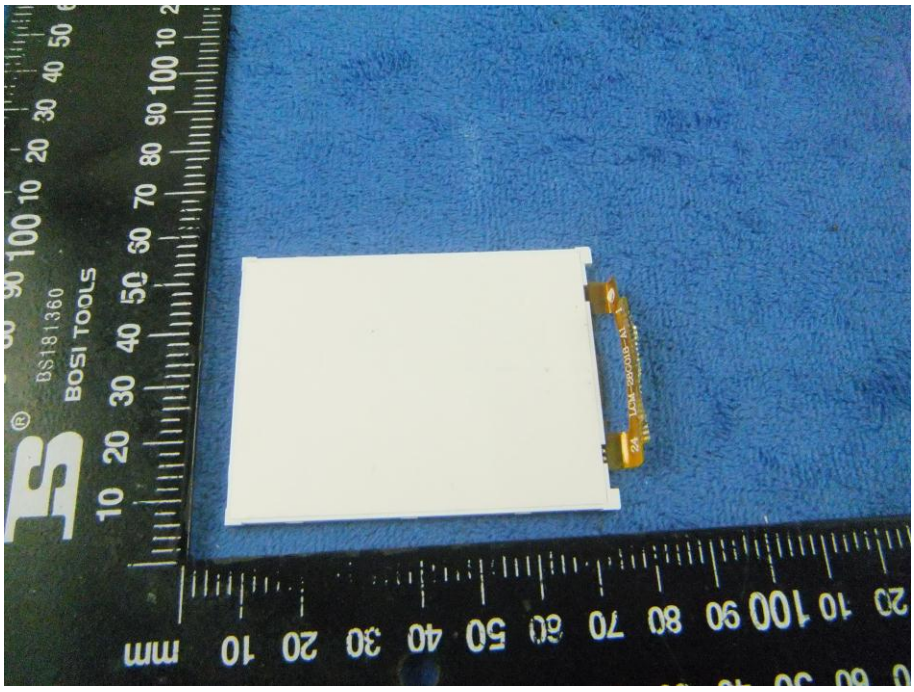
Small Mainboard - Rear View



LCD – Front View

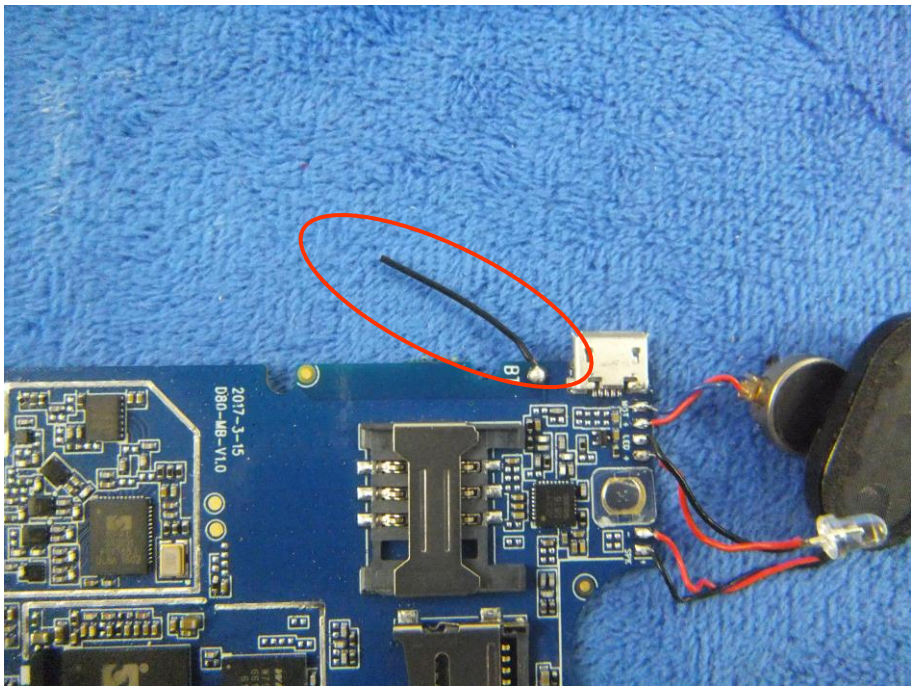


LCD – Rear View

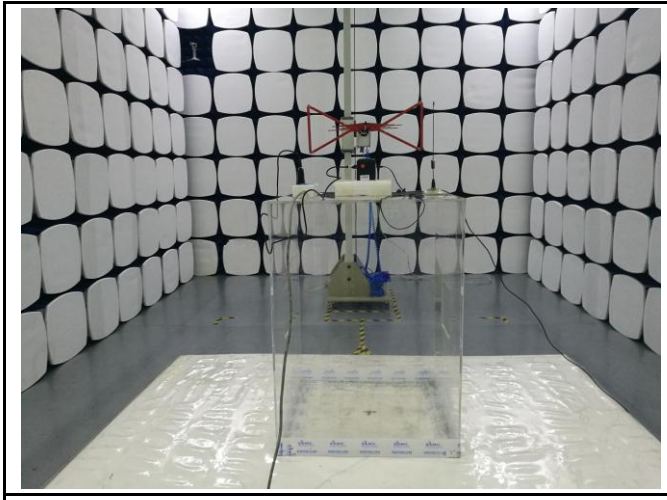
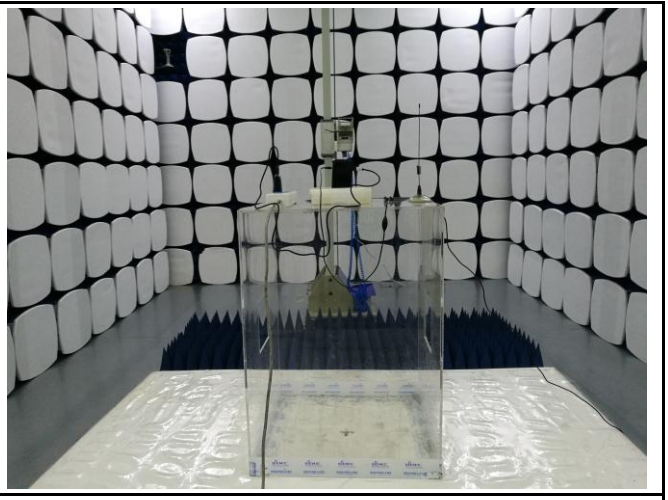


GSM/PCS/UMTS - Antenna View

BT - Antenna View



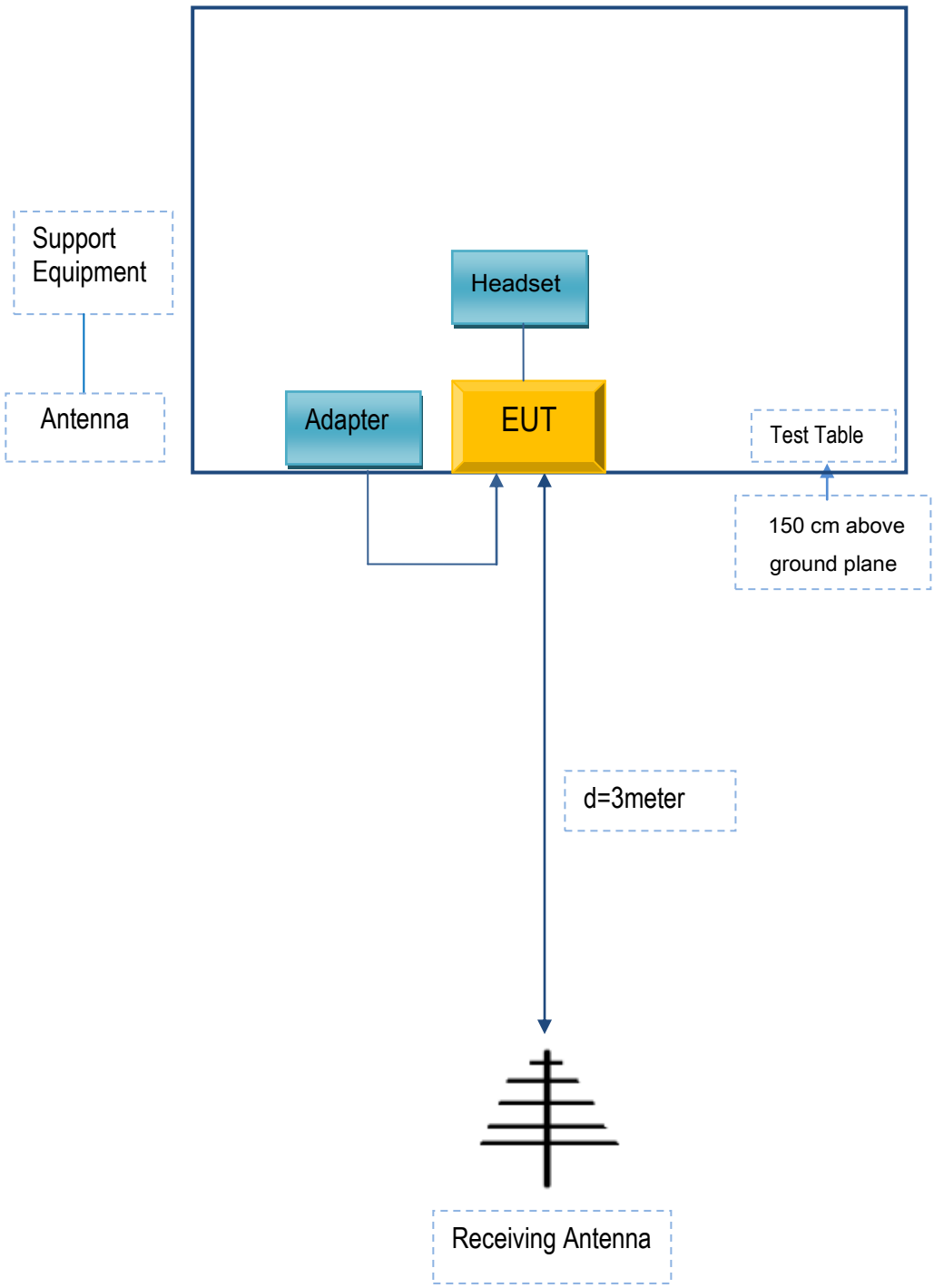
Annex B.iii. Photograph: Test Setup Photo

	
Radiated Spurious Emissions Test Setup Below 1GHz	Radiated Spurious Emissions Test Setup Above 1GHz

Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.ii. TEST SET UP BLOCK

Block Configuration Diagram for Radiated Emissions



Annex C. il. 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
Jethro Trading LTD.	Adapter	HJ-050050-US	N/A
SAMSUNG	headset	HS330	N/A
Agilent	Wireless Connectivity Test Set	N4010A	N/A
OEM	omnidirectional antenna	AntSuck	N/A

Supporting Cable:

Cable type	Shield Type	Ferrite Core	Length	Serial No
USB Cable	Un-shielding	No	0.8m	N/A

Annex C.ii. EUT OPERATING CONKITIONS

N/A

Annex D. User Manual / Block Diagram / Schematics / Partlist

Please see the attachment

Annex E. DECLARATION OF SIMILARITY

N/A