FCC PART 22/24 TEST REPORT

FCC Part 22 /Part 24

Report Reference No.:	HK1810291392E	
FCC ID:	2AFD9SMARTKIDS	
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Date of issue:	Oct. 29, 2018	
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Applicant's name :	MOVEON TECHNOLOGY LIMITED	
Address :	world trade plaza-A block #3201-3202 Fuhong Road, Futian	
Standard :	FCC Part 22: PUBLIC MOBILE SERVICES FCC Part 24: PERSONAL COMMUNICATIONS SERVICES	

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Test item description :	Smart Watch
Brand Name :	ZOOM
Model	SmartKids
Ratings :	DC 3.7V From Battery; DC3.7V/0.4A
Modulation :	GSM / GPRS :GMSK
GPRS	Supported
Hardware version:	G610S-MB-V1.3
Software version :	G610S-SW-V1.0
Frequency	GSM 850MHz; PCS 1900MHz;
Result :	PASS

TEST REPORT

Test Report No. : **HK1810291392E**	Oct. 29, 2018 Date of issue

Equipment under Test	:	Smart Watch
Model /Type	:	SmartKids
Applicant	:	MOVEON TECHNOLOGY LIMITED
Address	:	world trade plaza-A block #3201-3202 Fuhong Road, Futian
Manufacturer	:	MOVEON TECHNOLOGY LIMITED
Address	:	world trade plaza-A block #3201-3202 Fuhong Road, Futian

Test Result:	**PASS**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision	Issue Date	Revisions	Revised By
V1.0	Oct. 29, 2018	Initial Issue	Jason Zhou

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1.TEST STANDARDS

The tests were performed according to following standards:

FCC Part 22 (10-1-12 Edition): PRIVATE LAND MOBILE RADIO SERVICES.

FCC Part 24(10-1-12 Edition): PUBLIC MOBILE SERVICES

TIA/EIA 603 D June 2010: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

2. SUMMARY

2.1 PRODUCT DESCRIPTION

A major technical description of EUT is described as following:

Product Designation:	Smart Watch
Frequency Bands:	☒GSM 850 ☒PCS1900 (U.S. Bands) ☒GSM 900 ☒DCS 1800 (Non-U.S. Bands)
Antenna Type	PIFA Antenna
Type of Modulation	GSM / GPRS :GMSK
Antenna gain	GSM850:1.0dBi; PCS1900: 1.2dBi;
Power Supply:	DC 3.7V by battery
Battery parameter:	DC3.7V/400mAh
Single Card:	GSM Card Slot
GPRS Class	12
Extreme Vol. Limits:	DC3.3 V to 4.20 V (Normal: DC3.7 V)
Extreme Temp. Tolerance	-10℃ to +50℃
*** Note: 1. The High Voltage DC4.20V and Low Voltage DC3.3V were declared by manufacturer 2. The EUT couldn't be operating normally with higher or lower voltage.	

***** Note:**1.The maximum power levels are GSM for MCS-4: GMSK link, only these modes were used for all tests.

2. We found out the test mode with the highest power level after we analyze all the data rates. So we chose worst cases a representative.

GSM Card 1 Slot :

	Maximum ERP/EIRP (dBm)	Max. Conducted Power (dBm)	Max. Average Burst Power (dBm)
GSM 850	30.40	32.45	31.77
PCS 1900	27.30	29.39	28.86

2.2 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID:2AFD9SMARTKIDS**, filing to comply with the FCC Part 22H&24E requirements.

2.3 TEST METHODOLOGY

The radiated emission testing was performed according to the procedures of ANSI/TIA-603-E-2016, and KDB 971168 D01 Power Means License Digital Systems V03R01.

2.4 TEST FACILITY

Site	Shenzhen HUAK Testing Technology Co., Ltd.
Location	1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China
Designation Number	CN1229
Test Firm Registration Number : 616276	

ALL TEST EQUIPMENT LIST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
Receiver	R&S	ESCI 7	HKE-010	2017/12/28	2018/12/27
LISN	R&S	ENV216	HKE-002	2017/12/28	2018/12/27
Spectrum analyzer	Agilent	N9020A	HKE-048	2017/12/28	2018/12/27
Horn antenna	Schwarzbeck	9120D	HKE-013	2017/12/28	2019/12/26
Preamplifier	EMCI	EMC051845SE	HKE-015	2017/12/28	2018/12/27
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	HKE-087	2017/12/28	2018/12/27
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	2017/12/28	2019/12/26
Spectrum analyzer	Agilent	N9020A	HKE-048	2017/12/28	2018/12/27
Power Sensor	Agilent	E9300A	HKE-086	2017/12/28	2018/12/27
Wireless Communication Test Set	R&S	CMU200	HKE-026	2017/12/28	2018/12/27

2.6 SPECIAL ACCESSORIES

The battery wassupplied by the applicant were used as accessories and being tested with EUT intended for FCC grant together.

2.7 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

3. SYSTEM TEST CONFIGURATION

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The Transmitter was operated in the maximum output power mode through Communication Tester. The TX frequency was fixed which was for the purpose of the measurements.

3.3 CONFIGURATION OF EUT SYSTEM

Fig. 2-1 Configuration of EUT System

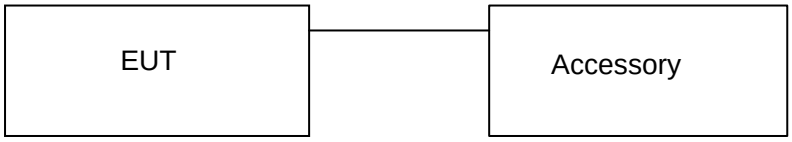


Table 2-1 Equipment Used in EUT System

Item	Equipment	Model No.	ID or Specification	Remark
1	Smart Watch	SmartKids	2AFD9SMARTKIDS	EUT
2	Battery	062626	DC 3.7V/400mAh	Accessory
3	USB	N/A	N/A	Accessory

***Note: All the accessories have been used during the test. The following "EUT" in setup diagram means EUT system.

4. SUMMARY OF TEST RESULTS

Item Number	Item Description		FCC Rules	Result
1	Output Power	Conducted Output Power	2.1046	Pass
		Radiated Output Power	22.913(a) (2) / 24.232 (c)	
2	Peak-to-Average Ratio	Peak-to-Average Ratio	24.232(d)	Pass
3	Spurious Emission	Conducted Spurious Emission	2.1051/22.917/24.238	Pass
		Radiated Spurious Emission		
4	Frequency Stability		2.1055/22.355/24.235	Pass
5	Occupied Bandwidth		2.1049	Pass
6	Band Edge		2.1051/22.917(a)/24.238(a)	Pass

5. DESCRIPTION OF TEST MODES

During the testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication Tester (CMU 200)to ensure max power transmission and proper modulation. Three channels (The top channel, the middle channel and the bottom channel) were chosen for testing on both GSM and PCS frequency band.

*****Note:** GSM/GPRS 850, GSM/GPRS 1900mode have been tested during the test.

The worst condition was recorded in the test report if no other modes test data.

6. OUTPUT POWER

6.1 CONDUCTED OUTPUT POWER

6.1.1 MEASUREMENT METHOD

The transmitter output port was connected to base station.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Measure the maximum burst average power and average power for other modulation signal.

The EUT was setup for the max output power with pseudo random data modulation. Power was measured with Spectrum Analyzer. The measurements were performed on all modes(GSM/GPRS 850, GSM/GPRS1900)at 3 typical channels(the Top Channel, the Middle Channel and the Bottom Channel) for each band.

6.1.2 MEASUREMENT RESULT

Conducted Output Power Limits for GPRS/GPRS 850 band		
Mode	**Nominal Peak Power**	**Tolerance(dB)**
GSM	33dBm (2W)	- 2
Conducted Output Power Limits for GPRS/GPRS 1900band		
Mode	**Nominal Peak Power**	**Tolerance(dB)**
GSM	30dBm (1W)	- 2

GSM 850:

Mode	Frequency (MHz)	Reference Power	Peak Power	Tolerance	Avg.Burst Power	Duty cycle Factor(dB)	Frame Power(dBm)
GSM850	824.2	33	**32.45**	-0.55	31.76	-9	22.76
	836.6	33	32.35	-0.65	31.7	-9	22.7
	848.8	33	32.42	-0.58	**31.77**	-9	22.77
GPRS850 (1 Slot)	824.2	33	32.24	-0.76	31.61	-9	22.61
	836.6	33	32.19	-0.81	31.54	-9	22.54
	848.8	33	32.1	-0.9	31.4	-9	22.4
GPRS850 (2 Slot)	824.2	30	29.47	-0.53	28.75	-6	22.75
	836.6	30	29.54	-0.46	28.91	-6	22.91
	848.8	30	29.45	-0.55	28.8	-6	22.8
GPRS850 (3 Slot)	824.2	28.23	28.13	-0.1	27.44	-4.26	23.18
	836.6	28.23	28	-0.23	27.36	-4.26	23.1
	848.8	28.23	28.06	-0.17	27.39	-4.26	23.13
GPRS850 (4 Slot)	824.2	27	26.23	-0.77	25.58	-3	22.58
	836.6	27	26.29	-0.71	25.64	-3	22.64
	848.8	27	26.52	-0.48	25.86	-3	22.86

PCS 1900:

Mode	Frequency (MHz)	Reference Power	Peak Power	Tolerance	Avg.Burst Power	Duty cycle Factor(dB)	Frame Power(dBm)
GSM1900	1850.2	30	29.26	-0.74	28.65	-9	19.65
	1880	30	**29.39**	-0.61	28.77	-9	19.77
	1909.8	30	29.13	-0.87	28.49	-9	19.49
GPRS1900 (1 Slot)	1850.2	30	29.36	-0.64	28.71	-9	19.71
	1880	30	29.38	-0.62	**28.86**	-9	19.86
	1909.8	30	29.27	-0.73	28.62	-9	19.62
GPRS1900 (2 Slot)	1850.2	27	25.24	-1.76	24.65	-6	18.65
	1880	27	25.19	-1.81	24.54	-6	18.54
	1909.8	27	25.35	-1.65	24.7	-6	18.7
GPRS1900 (3 Slot)	1850.2	25.23	24.15	-1.08	23.51	-4.26	19.25
	1880	25.23	24.32	-0.91	23.67	-4.26	19.41
	1909.8	25.23	24.23	-1	23.64	-4.26	19.38
GPRS1900 (4 Slot)	1850.2	24	23.29	-0.71	22.7	-3	19.7
	1880	24	23.51	-0.49	22.95	-3	19.95
	1909.8	24	23.35	-0.65	22.77	-3	19.77

According to 3GPP 25.101 sub-clause 6.2.2 , the maximum output power is allowed to be reduced by following the table.

Table 6.1aA: UE maximum output power with HS-DPCCH and E-DCH

UE Transmit Channel Configuration	CM(db)	MPR(db)
For all combinations of ,DPDCH,DPCCH HS-DPDCH,E-DPDCH and E-DPCCH	0≤ CM≤3.5	MAX(CM-1,0)
Note: CM=1 for β_c/β_d=12/15,β_{hs}/β_c=24/15.For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.		

The device supports MPR to solve linearity issues (ACLR or SEM) due to the higher peak-to average ratios (PAR) of the HSUPA signal. This prevents saturating the full range of the TX DAC inside of device and provides a reduced power output to the RF transceiver chip according to the Cubic Metric (a function of the combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH).

When E-DPDCH channels are present the beta gains on those channels are reduced firsts to try to get the power under the allowed limit. If the beta gains are lowered as far as possible, then a hard limiting is applied at the maximum allowed level.

The SW currently recalculates the cubic metric every time the beta gains on the E-DPDCH are reduced. The cubic metric will likely get lower each time this is done .However, there is no reported reduction of maximum output power in the HSUPA mode since the device also provides a compensate for the power back-off by increasing the gain of TX_AGC in the transceiver (PA) device.

The end effect is that the DUT output power is identical to the case where there is no MPR in the device.

6.2 RADIATED OUTPUT POWER

6.2.1 MEASUREMENT METHOD

The measurements procedures specified in ANSI/TIA-603-E-2016 were applied.

1. Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signal operating below 1GHz are performed using dipole antennas. Measurements on signals operating above 1GHz are performed using broadband horn antennas. All measurements are performed as RMS average measurements while the EUT operating at its maximum duty cycle, at maximum power, and at the approximate frequencies.
2. In an anechoic antenna test chamber, a half-wave dipole antenna for the frequency band of interest is placed at the reference centre of the chamber. An RF Signal source for the frequency band of interest is connected to the dipole with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A known (measured) power (Pin) is applied to the input of the dipole, and the power received (Pr) at the chamber's probe antenna is recorded.
3. The substitution method is used. Substitution values at each frequency are measured before and saved to the test software. A "reference path loss" is established as ARpl=Pin + 2.15 - Pr. TheARpl is the attenuation of “reference path loss”, and including the gain of receive antenna, the cable loss and the air loss. The measurement results are obtained as described below: Power=PMea+ARpl
4. The EUT is substituted for the dipole at the reference centre of the chamber and a scan is performed to obtain the radiation pattern.
5. From the radiation pattern, the co-ordinates where the maximum antenna gain occurs are identified.
6. The EUT is then put into continuously transmitting mode at its maximum power level.
7. Power mode measurements are performed with the receiving antenna placed at the coordinates determined in Step 3 to determine the output power as defined in Rule 24.232 (b) and (c). The "reference path loss" from Step1 is added to this result.
8. This value is EIRP since the measurement is calibrated using a half-wave dipole antenna of known gain (2.15 dBi) and known input power (Pin).
9. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi...

6.2.2 PROVISIONS APPLICABLE

Mode	FCC Part Section(s)	Nominal Peak Power
GSM/GPRS 850	22.913(a)(2)	<=38.45dBm (7W). ERP
GSM/GPRS 1900	24.232(c)	<=33dBm (2W). EIRP

6.2.3 MEASUREMENT RESULT

Radiated Power (ERP) for GSM/GPRS 850				
Mode	Frequency	Result		Conclusion
		Max. Peak ERP (dBm)	Polarization Of Max. ERP	
GSM	824.2	30.39	Horizontal	Pass
	836.6	30.26	Horizontal	Pass
	848.8	**30.40**	Horizontal	Pass
	824.2	30.01	Vertical	Pass
	836.6	29.90	Vertical	Pass
	848.8	29.89	Vertical	Pass

Radiated Power (E.I.R.P) for GSM/GPRS 1900				
Mode	Frequency	Result		Conclusion
		Max. Peak E.I.R.P.(dBm)	Polarization Of Max. E.I.R.P.	
GSM	1850.2	27.20	Horizontal	Pass
	1880.0	**27.30**	Horizontal	Pass
	1909.8	27.11	Horizontal	Pass
	1850.2	27.13	Vertical	Pass
	1880.0	27.09	Vertical	Pass
	1909.8	27.06	Vertical	Pass

Note: Above is the worst mode data.

6.3. PEAK-TO-AVERAGE RATIO

6.3.1 MEASUREMENT METHOD

Use one of the procedures presented in 4.1 to measure the total peak power and record as PPk. Use one of the applicable procedures presented 4.2 to measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

PAPR (dB) = PPk (dBm) - PAvg (dBm).

6.3.2 PROVISIONS APPLICABLE

This is the test for the Peak-to-Average Ratio from the EUT.

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument’s resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

6.3.3 MEASUREMENT RESULT

Modes	GSM850(GSM)		
Channel	128	190	251
	(Low)	(Mid)	(High)
Frequency (MHz)	824.2	836.6	848.8
Peak-To-Average Ratio (dB)/GSM	2.66	2.66	2.65
Peak-To-Average Ratio (dB)/GPRS	2.66	2.66	2.67

Modes	PCS1900 (GSM)		
Channel	512	661	810
	(Low)	(Mid)	(High)
Frequency (MHz)	1850.2	1880	1909.8
Peak-To-Average Ratio (dB)/GSM	2.69	2.70	2.70
Peak-To-Average Ratio (dB)/GPRS	2.69	2.71	2.70

7. OCCUPIED BANDWIDTH

7.1 MEASUREMENT METHOD

1. The Occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper Frequency limits, the mean power radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

2. RBW=1~5% of the expected OBW, VBW>=3 x RBW, Detector=Peak, Trace mode=max hold, Sweep=auto couple, and the trace was allowed to stabilize.

7.2 PROVISIONS APPLICABLE

The emission bandwidth is defined as two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26dB below the transmitter power

7.3 MEASUREMENT RESULT

Test Results

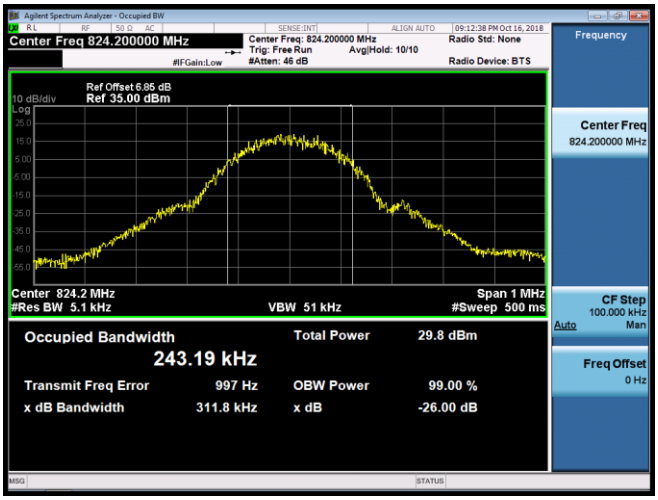
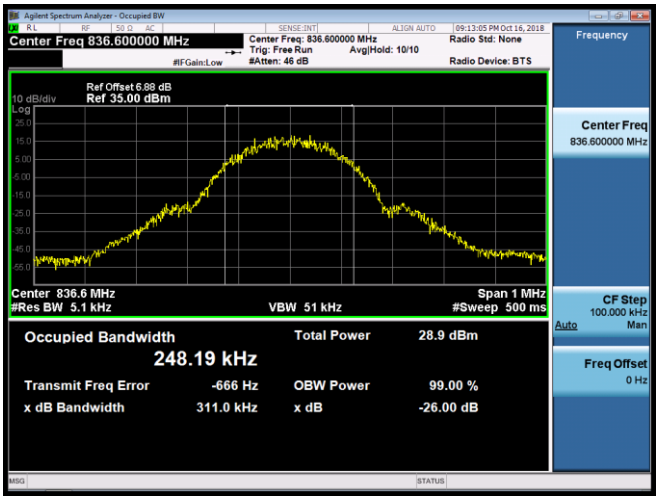
Test Band	Test Mode	Test Channel	Occupied Bandwidth (KHZ)	Emission Bandwidth (KHZ)	Verdict
GSM850	GSM	LCH	243.19	311.8	PASS
		MCH	248.19	311.0	PASS
		HCH	245.48	310.7	PASS
	GPRS	LCH	244.61	320.0	PASS
		MCH	246.31	320.3	PASS
		HCH	242.88	311.1	PASS

Test Band	Test Mode	Test Channel	Occupied Bandwidth (KHZ)	Emission Bandwidth (KHZ)	Verdict
GSM1900	GSM	LCH	243.03	309.3	PASS
		MCH	242.73	314.2	PASS
		HCH	243.77	300.9	PASS
	GPRS	LCH	243.17	310.2	PASS
		MCH	247.00	309.9	PASS
		HCH	246.08	306.9	PASS

For GSM

Test Band=GSM850/PCS1900

Test Mode=GSM/GPRS

GSM 850-LCH-GSM	GSM 850-MCH-GSM
	
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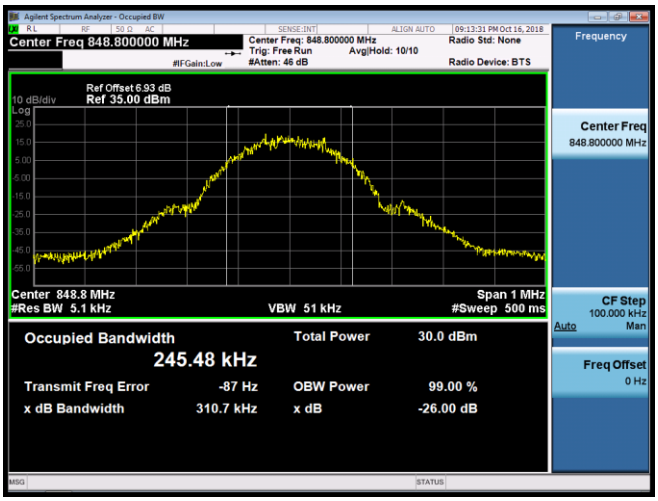
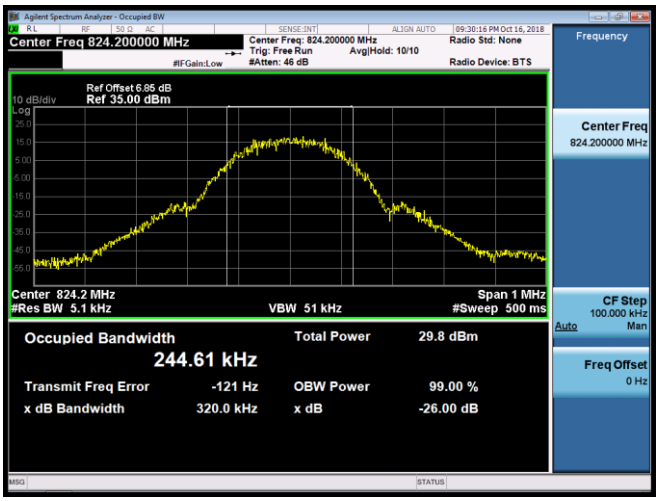
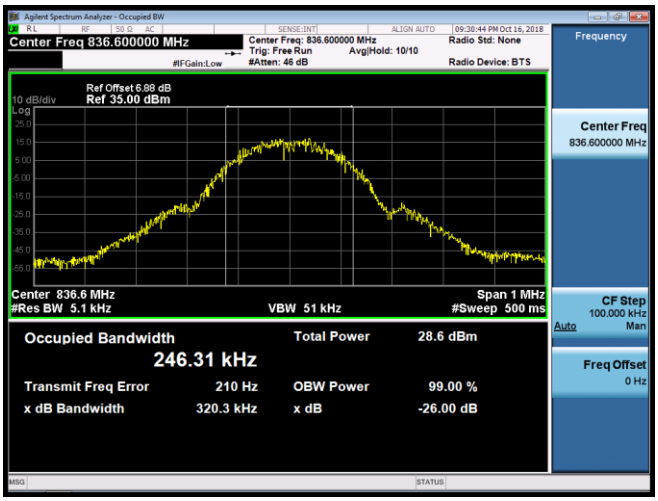
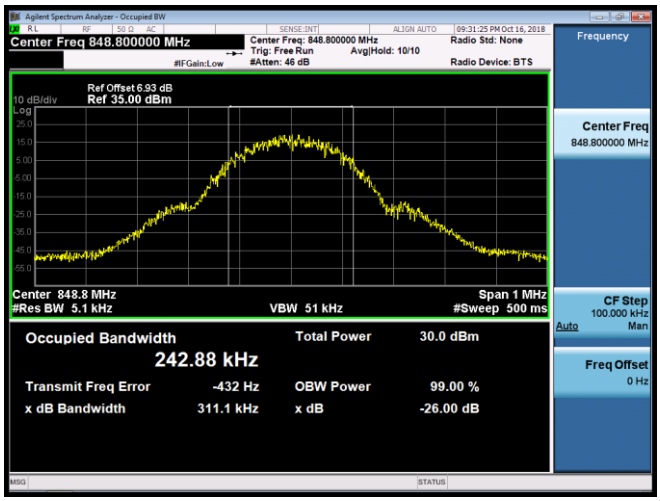
	

GSM 850-MCH-GPRS	GSM 850-HCH-GPRS
	

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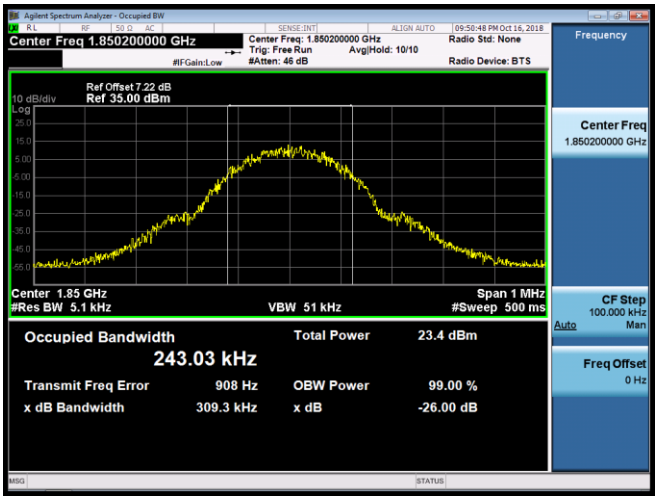
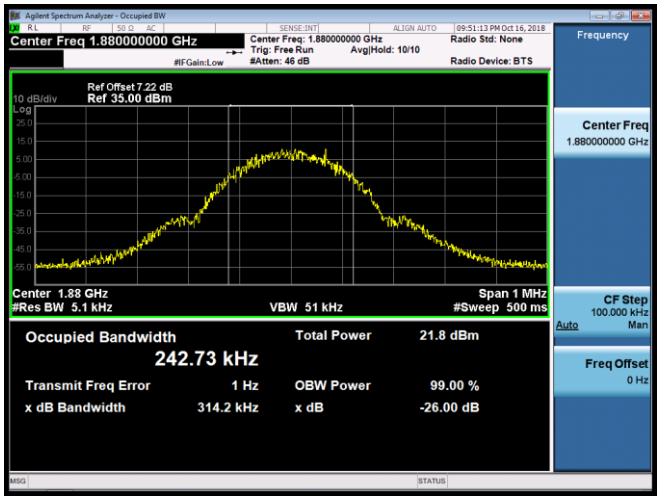
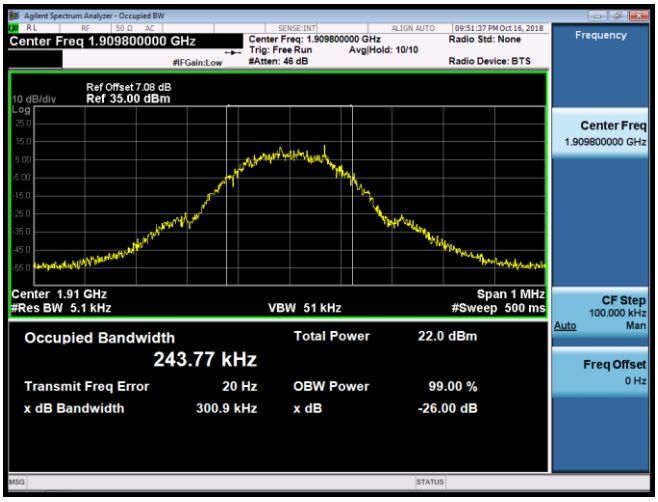
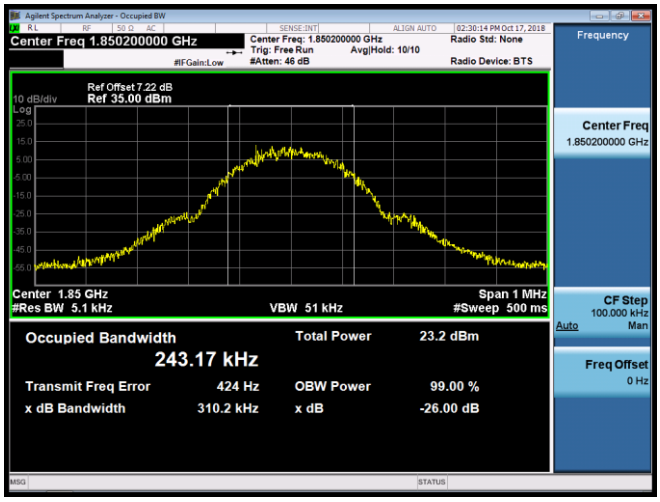
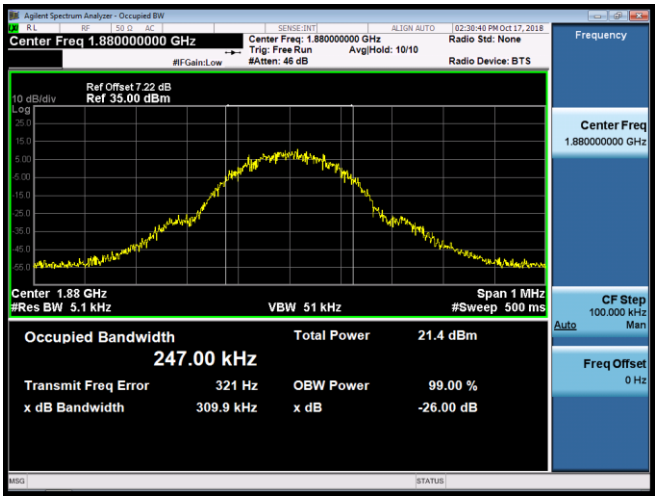
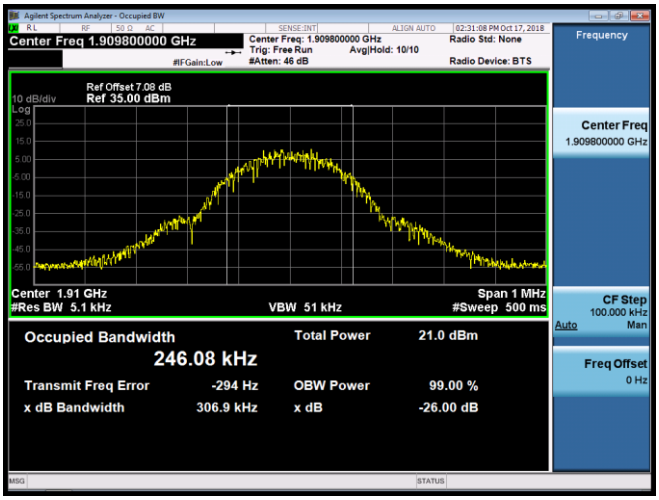
	

GSM 1900-HCH-GSM	GSM 1900-LCH-GPRS
	

GSM 1900-MCH-GPRS	GSM 1900-HCH-GPRS
	

8. BAND GPRS

8.1 MEASUREMENT METHOD

1. All out of band emissions are measured with an analyzer spectrum connected to the antenna terminal of the EUT while the EUT at its maximum duty cycle, at maximum power, and at the approximate frequencies. All data rates were investigated to determine the worst case configuration
2. The test set up and general procedure is similar to conducted peak output power test. Only different for setting the measurement configuration of the measuring instrument of Spectrum Analyzer.
3. Start and stop frequency were set such that the band edge would be placed in the center of the plot.
4. Span was set large enough so as to capture all out of band emissions near the band edge.
5. RBW>1% of the emission bandwidth, VBW >=3 x RBW, Detector=RMS, Number of points>=2 x Span/RBW, Trace mode=max hold, Sweep time=auto couple, and the trace was allowed to stabilize

8.2 PROVISIONS APPLICABLE

As Specified in FCC rules of 22.917(a) 、24.238(a)and KDB 971168 D1 V03R01.

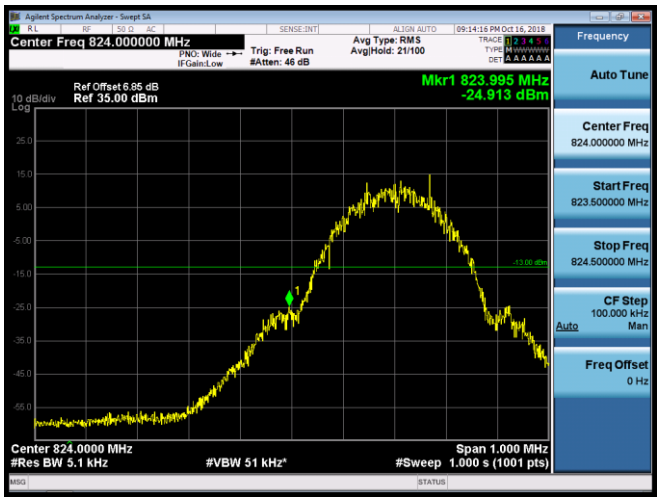
8.3 MEASUREMENT RESULT

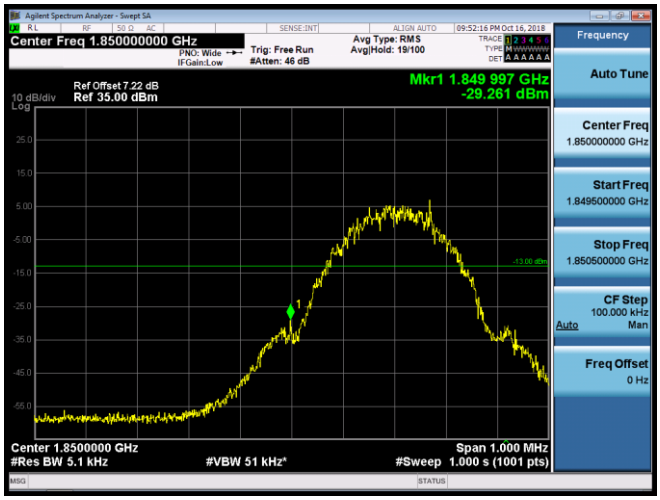
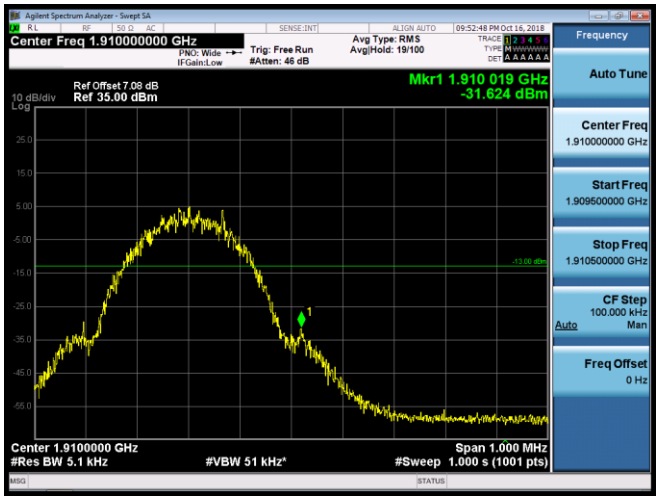
Test Results

For GSM

Test Band=GSM850/GSM1900

Test Mode=GSM/GPRS

GSM 850-LCH-GSM	GSM 850-HCH-GSM
	

GSM 1900-LCH-GSM	GSM 1900-HCH-GSM
	

9. SPURIOUS EMISSION

9.1 CONDUCTED SPURIOUS EMISSION

9.1.1MEASUREMENT METHOD

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. The level of the carrier and the various conducted spurious and harmonic frequency is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the approximate frequencies. All data rates were investigated to determine the worst case configuration.

2. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of PCS1900 band, this equates to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For GSM850, data taken from 30 MHz to 9 GHz.

3. Determine EUT transmit frequencies: the following typical channelswere chosen to conducted emissions testing.

Typical Channels for testing of GSM 850	
Channel	Frequency (MHz)
128	824.2
190	836.6
251	848.8

Typical Channels for testing of PCS 1900	
Channel	Frequency (MHz)
512	1850.2
661	1880.0
810	1909.8

9.1.2 PROVISIONS APPLICABLE

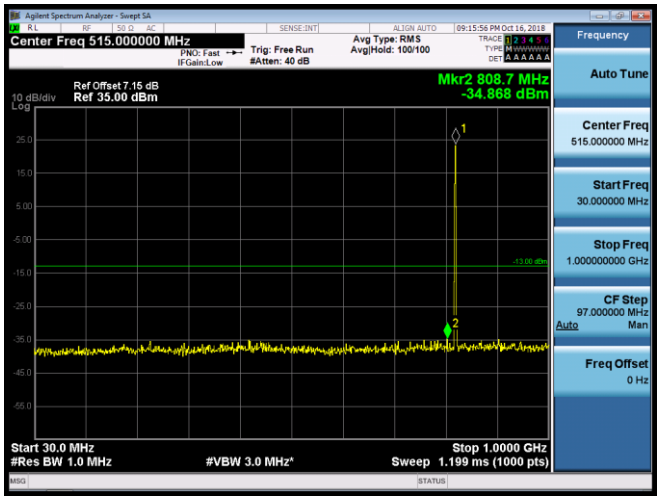
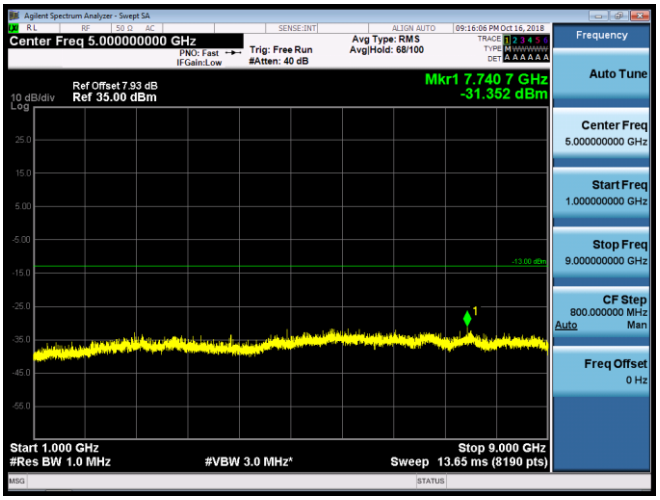
On any frequency outside frequency band of the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

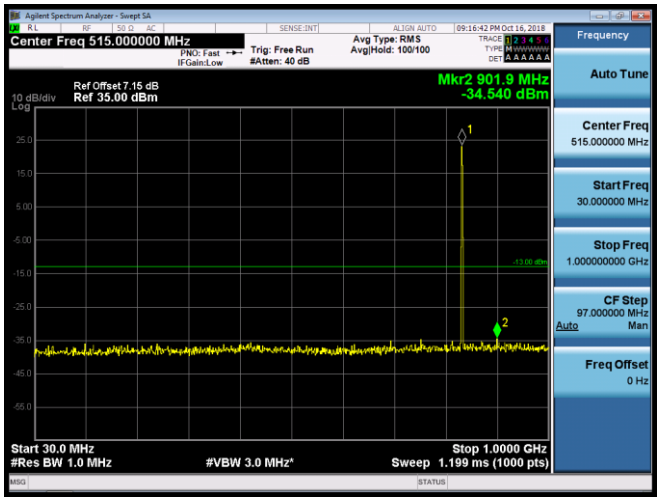
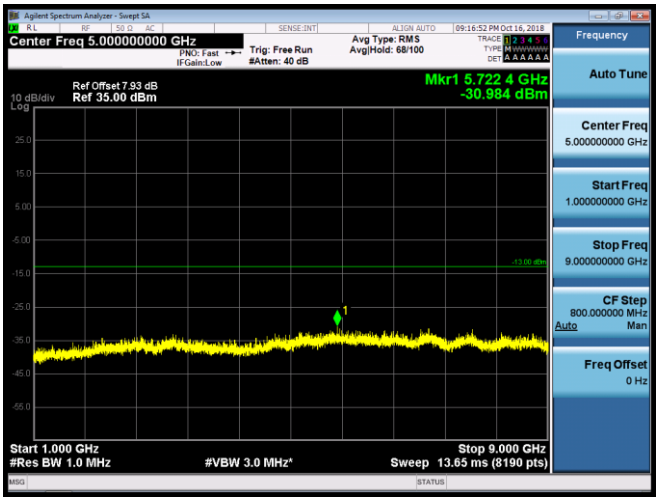
9.1.3MEASUREMENT RESULT

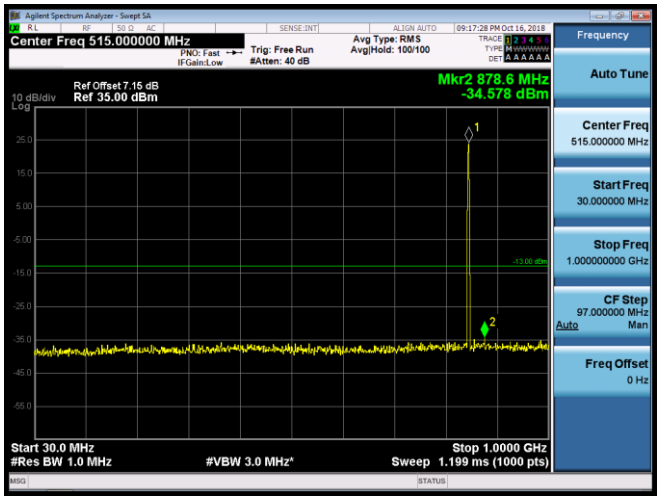
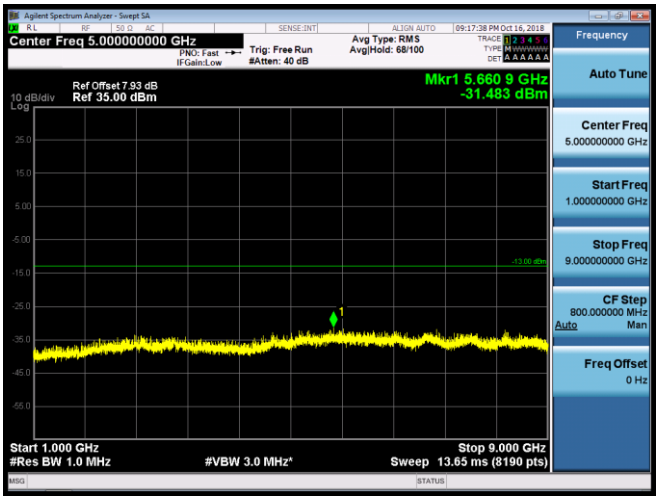
Test Results

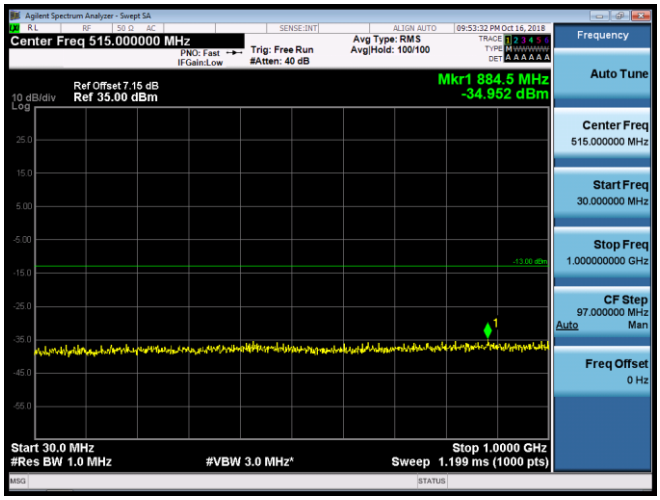
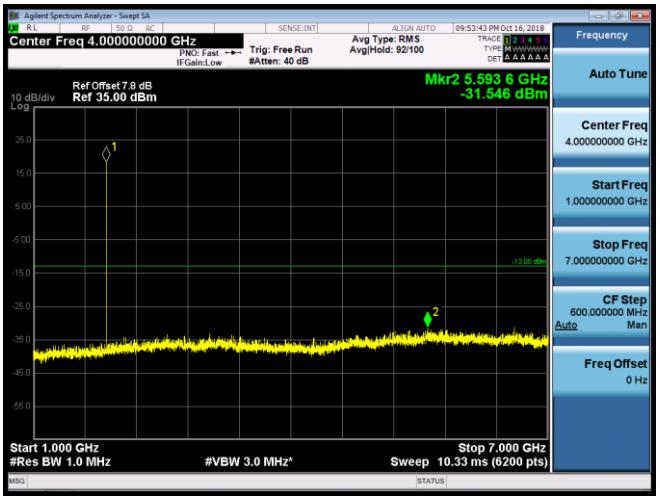
Test Band=GSM850/GSM1900

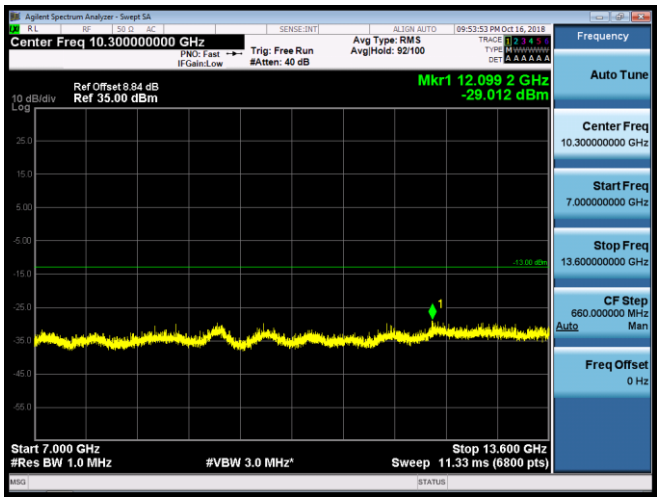
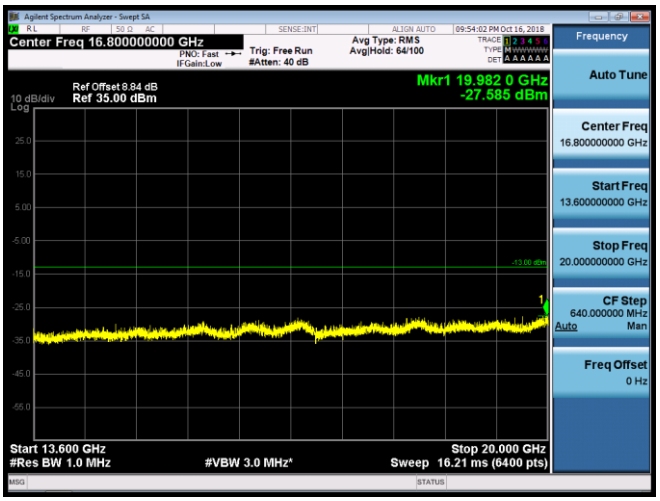
Test Mode=GSM/GPRS

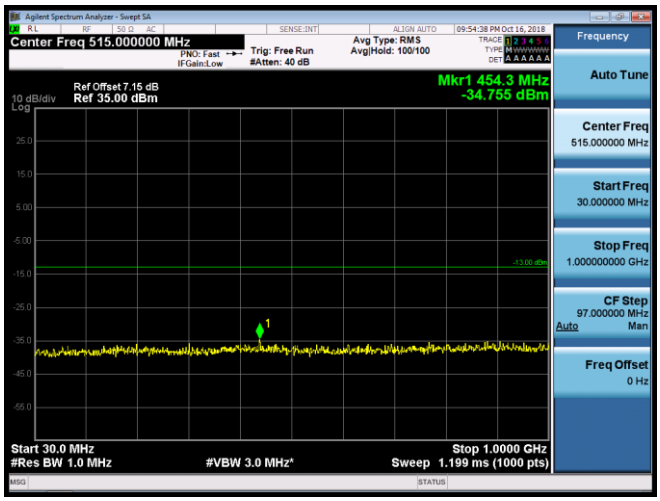
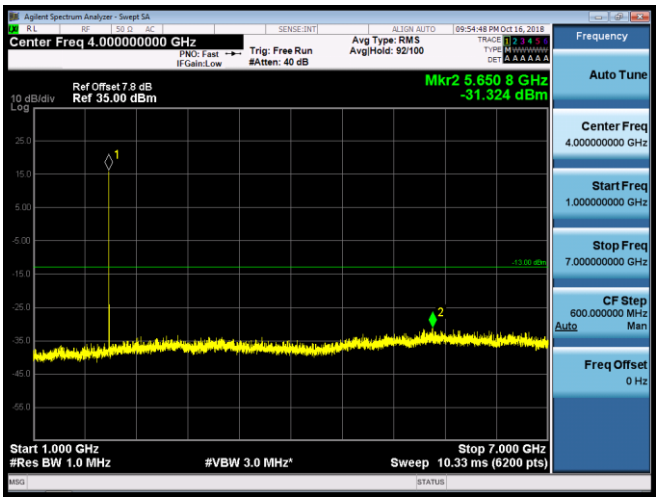
GSM 850-LCH-GSM	GSM 850-LCH-GSM
	

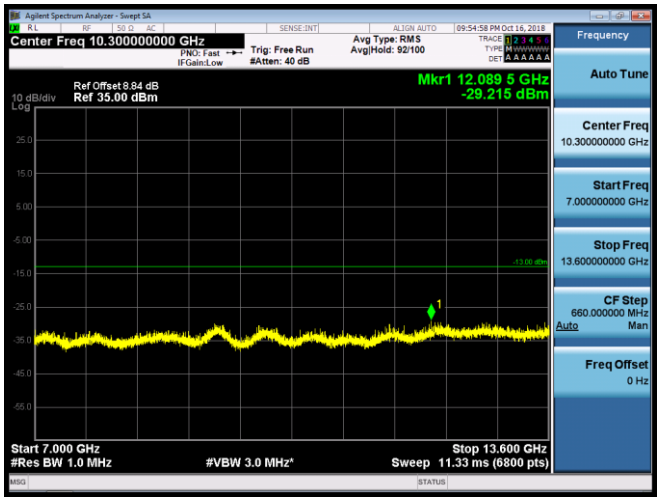
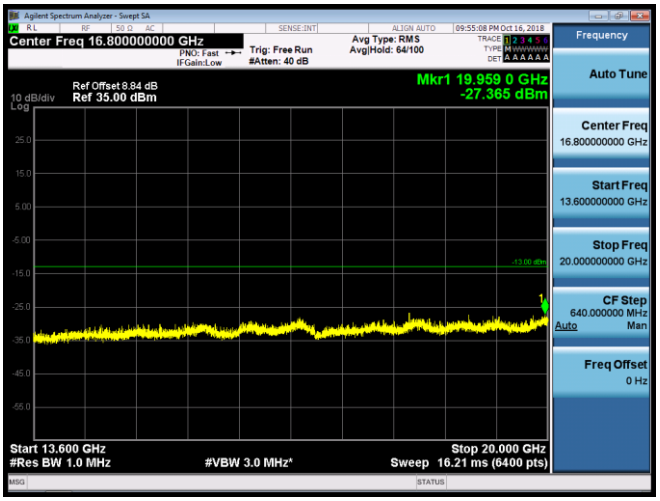
GSM 850-MCH-GSM	GSM 850-MCH-GSM
	

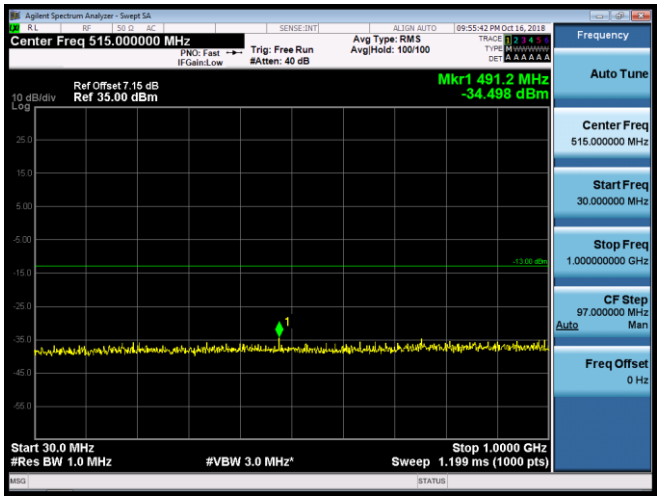
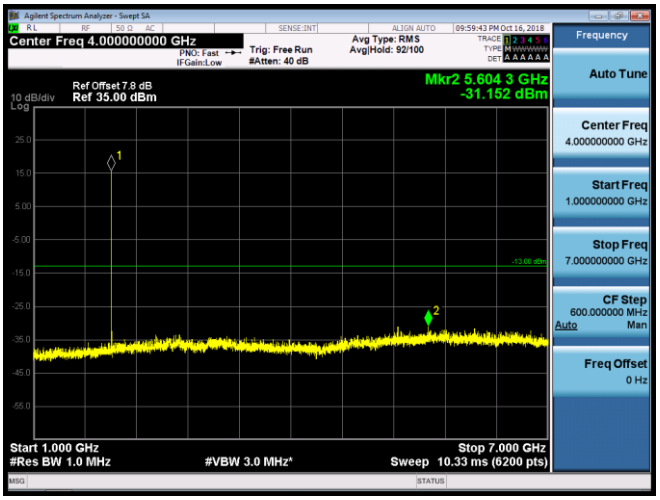
GSM 850-HCH-GSM	GSM 850-HCH-GSM
	

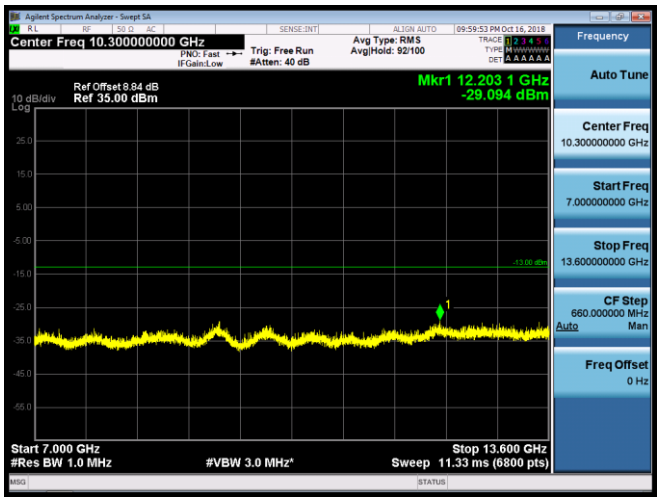
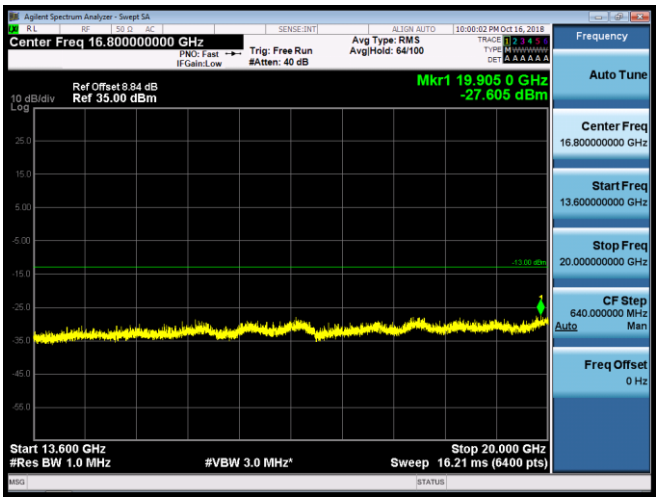
GSM 1900-LCH-GSM	GSM 1900-LCH-GSM
	

GSM 1900-LCH-GSM	GSM 1900-LCH-GSM
	

GSM 1900-MCH-GSM	GSM 1900-MCH-GSM
	

GSM 1900-MCH-GSM	GSM 1900-MCH-GSM
	

GSM 1900-HCH-GSM	GSM 1900-HCH-GSM
	

GSM 1900-HCH-GSM	GSM 1900-HCH-GSM
	

Note:1. Below 30MHZ no Spurious found and Above is the worst mode data.

2. As no emission found in standby or receive mode, no recording in this report.

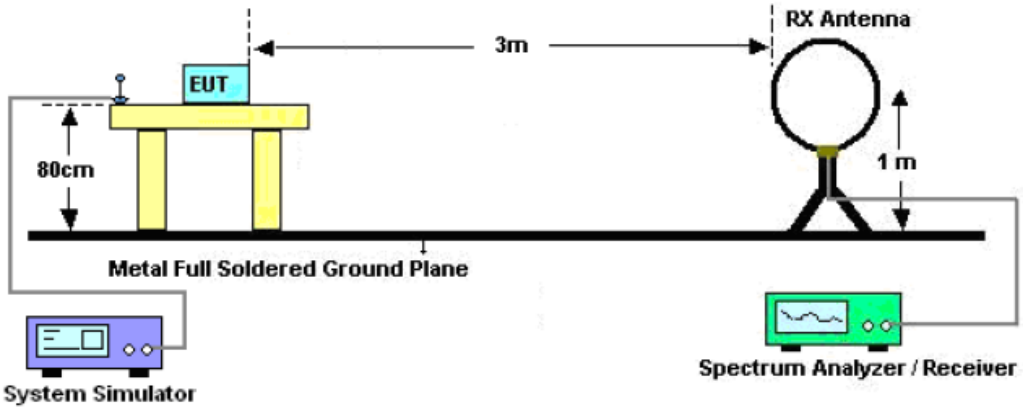
9.2 RADIATED SPURIOUS EMISSION

9.2.1MEASUREMENT METHOD

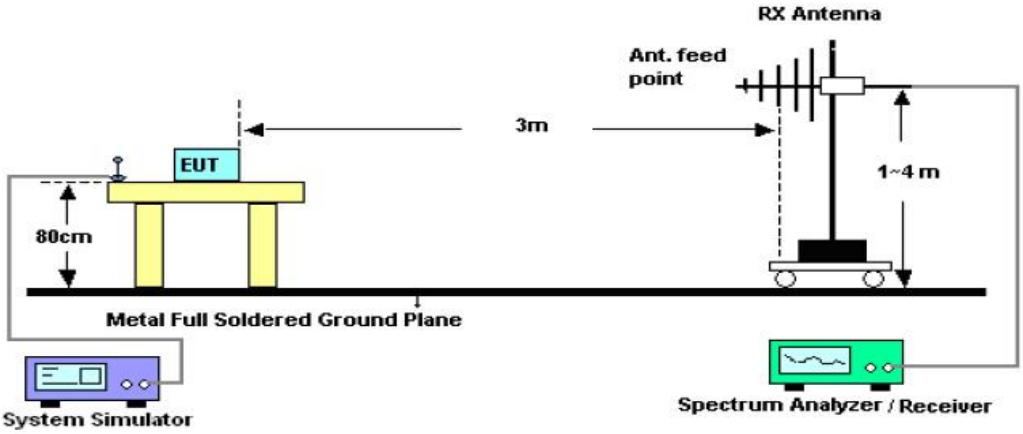
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

9.2.2 TEST SETUP

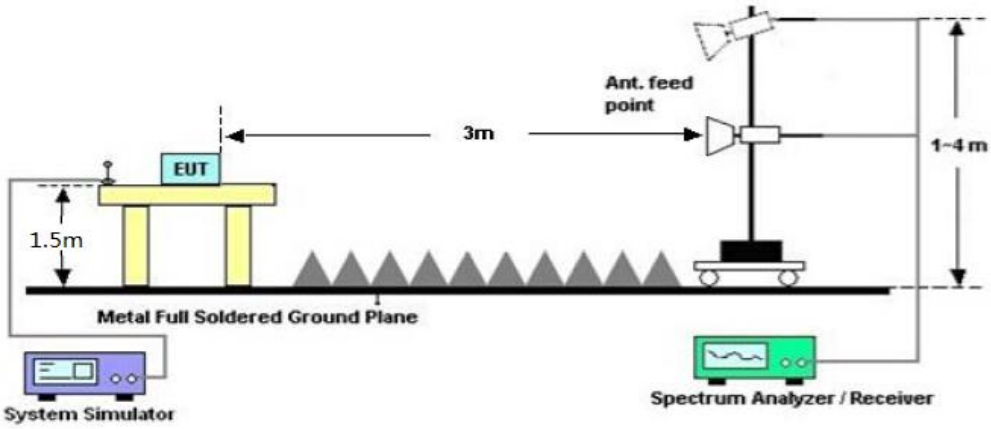
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



9.2.3 PROVISIONS APPLICABLE

(a) On any frequency outside a licensee's frequency block (e.g. A, D, B, etc.) within the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

Note: only result the worst condition of each test mode:

9.2.4 MEASUREMENT RESULT

GSM 850:

The Worst Test Results for Channel 251/848.8 MHz				
Frequency (MHz)	Emission Level (dBm)	Limits (dBm)	Margin (dB)	Comment
1967.60	-47.54	-13	-34.54	Horizontal
3456.47	-34.80	-13	-21.80	Horizontal
6722.25	-37.41	-13	-24.41	Horizontal
1967.60	-48.45	-13	-35.45	Vertical
3399.54	-36.46	-13	-23.46	Vertical
6749.64	-37.53	-13	-24.53	Vertical

PCS 1900:

The Worst Test Results for Channel 810/1909.8MHz				
Frequency (MHz)	Emission Level (dBm)	Limits (dBm)	Margin (dB)	Comment
1847.89	-47.51	-13	-34.51	Horizontal
3819.60	-34.78	-13	-21.78	Horizontal
7852.19	-37.37	-13	-24.37	Horizontal
1845.48	-48.46	-13	-35.46	Vertical
3819.60	-36.47	-13	-23.47	Vertical
7633.25	-37.51	-13	-24.51	Vertical

RESULT: PASS

Note:

1. Margin = Emission Level -Limit
2. Below 30MHZ no Spurious found and Above is the worst mode data.

10. FREQUENCY STABILITY

10.1 MEASUREMENT METHOD

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMU200 DIGITAL RADIO COMMUNICATION TESTER.

1 Measure the carrier frequency at room temperature.

2 Subject the EUT to overnight soak at -10℃.

3 With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on channel 661 for PCS 1900 band , channel 190 for GSM 850 band, channel 9400 for UMTS band II and channel 4175 for UMTS band V measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.

4 Repeat the above measurements at 10℃ increments from -10℃ to +50℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.

5 Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.

6 Subject the EUT to overnight soak at +50℃.

7 With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.

8 Repeat the above measurements at 10℃ increments from +50℃ to -10℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.

9 At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

10.2 PROVISIONS APPLICABLE

10.2.1 FOR HAND CARRIED BATTERY POWERED EQUIPMENT

According to the ANSI/TIA-603-E-2016, the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.3VDC and 4.2VDC, with a nominal voltage of 3.7VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance of -10 % and +12.5 %. For the purposes of measuring frequency stability these voltage limits are to be used.

10.2.2 FOR EQUIPMENT POWERED BY PRIMARY SUPPLY VOLTAGE

According to the ANSI/TIA-603-E-2016,the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment, the normal environment temperature is 20°C.

10.3 MEASUREMENT RESULT

Test Results

Frequency Error vs. Voltage:

Test Band	Test Mode	Test Channel	Test Temp.	Test Volt.(V)	Freq.Error (Hz)	Freq.vs.rated (ppm)	Limit (ppm)	Verdict
GSM850	GSM	LCH	TN	VL	-17.76	-0.02	±2.5	PASS
			TN	VN	-18.53	-0.02	±2.5	PASS
			TN	VH	-18.60	-0.02	±2.5	PASS
		MCH	TN	VL	-16.92	-0.02	±2.5	PASS
			TN	VN	-15.63	-0.02	±2.5	PASS
			TN	VH	-17.89	-0.02	±2.5	PASS
		HCH	TN	VL	-11.49	-0.01	±2.5	PASS
			TN	VN	-17.69	-0.02	±2.5	PASS
			TN	VH	-14.08	-0.01	±2.5	PASS

Test Band	Test Mode	Test Channel	Test Temp.	Test Volt.(V)	Freq.Error (Hz)	Freq.vs.rated (ppm)	Limit (ppm)	Verdict
GSM850	GPRS	LCH	TN	VL	-19.82	-0.02	±2.5	PASS
			TN	VN	-12.98	-0.02	±2.5	PASS
			TN	VH	-14.66	-0.02	±2.5	PASS
		MCH	TN	VL	-15.24	-0.02	±2.5	PASS
			TN	VN	-16.08	-0.02	±2.5	PASS
			TN	VH	-15.05	-0.02	±2.5	PASS
		HCH	TN	VL	-14.72	-0.02	±2.5	PASS
			TN	VN	-14.27	-0.02	±2.5	PASS
			TN	VH	-14.14	-0.02	±2.5	PASS

Test Band	Test Mode	Test Channel	Test Temp.	Test Volt. (V)	Freq.Error (Hz)	Freq.vs.rated (ppm)	Limit (ppm)	Verdict
PCS 1900	GSM	LCH	TN	VL	-29.64	-0.02	±2.5	PASS
			TN	VN	-26.09	-0.01	±2.5	PASS
			TN	VH	-29.06	-0.02	±2.5	PASS
		MCH	TN	VL	-31.51	-0.02	±2.5	PASS
			TN	VN	-30.35	-0.02	±2.5	PASS
			TN	VH	-27.25	-0.01	±2.5	PASS
		HCH	TN	VL	-29.25	-0.02	±2.5	PASS
			TN	VN	-26.54	-0.01	±2.5	PASS
			TN	VH	-32.74	-0.02	±2.5	PASS

Test Band	Test Mode	Test Channel	Test Temp.	Test Volt. (V)	Freq.Error (Hz)	Freq.vs.rated (ppm)	Limit (ppm)	Verdict
PCS 1900	GPRS	LCH	TN	VL	-26.22	-0.01	±2.5	PASS
			TN	VN	-23.96	-0.01	±2.5	PASS
			TN	VH	-20.21	-0.01	±2.5	PASS
		MCH	TN	VL	-26.93	-0.01	±2.5	PASS
			TN	VN	-26.99	-0.01	±2.5	PASS
			TN	VH	-27.89	-0.01	±2.5	PASS
		HCH	TN	VL	-29.25	-0.02	±2.5	PASS
			TN	VN	-31.19	-0.02	±2.5	PASS
			TN	VH	-28.09	-0.01	±2.5	PASS

Frequency Error vs. Temperature:

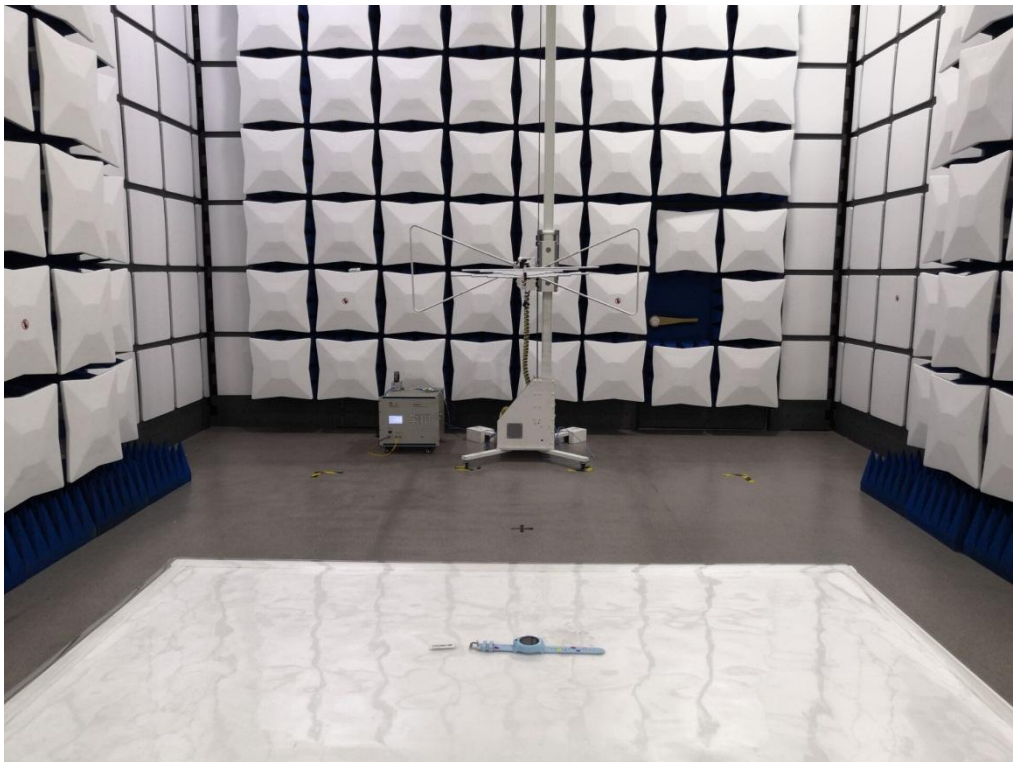
Test Band	Test Mode	Test Channel	Test Volt.	Test Tem. (℃)	Freq.Error (Hz)	Freq.vs.rated (ppm)	Limit (ppm)	Verdict
GSM850	GSM	LCH	VN	-10	-15.76	-0.02	±2.5	PASS
			VN	0	-18.21	-0.02	±2.5	PASS
			VN	10	-18.14	-0.02	±2.5	PASS
			VN	20	-17.56	-0.02	±2.5	PASS
			VN	30	-16.14	-0.02	±2.5	PASS
			VN	40	-17.37	-0.02	±2.5	PASS
			VN	50	-15.50	-0.02	±2.5	PASS
GSM850	GSM	MCH	VN	-10	-16.34	-0.02	±2.5	PASS
			VN	0	-16.34	-0.02	±2.5	PASS
			VN	10	-16.85	-0.02	±2.5	PASS
			VN	20	-17.76	-0.02	±2.5	PASS
			VN	30	-13.56	-0.02	±2.5	PASS
			VN	40	-16.85	-0.02	±2.5	PASS
			VN	50	-17.95	-0.02	±2.5	PASS
GSM850	GSM	HCH	VN	-10	-14.79	-0.02	±2.5	PASS
			VN	0	-11.62	-0.01	±2.5	PASS
			VN	10	-16.21	-0.02	±2.5	PASS
			VN	20	-12.20	-0.01	±2.5	PASS
			VN	30	-17.89	-0.02	±2.5	PASS
			VN	40	-16.85	-0.02	±2.5	PASS
			VN	50	-15.05	-0.02	±2.5	PASS

Test Band	Test Mode	Test Channel	Test Volt.	Test Tem. (℃)	Freq.Error (Hz)	Freq.vs.rated (ppm)	Limit (ppm)	Verdict
GSM850	GPRS	LCH	VN	-10	-8.14	-0.01	±2.5	PASS
			VN	0	-8.85	-0.01	±2.5	PASS
			VN	10	-8.52	-0.01	±2.5	PASS
			VN	20	-10.40	-0.01	±2.5	PASS
			VN	30	-11.24	-0.01	±2.5	PASS
			VN	40	-14.33	-0.01	±2.5	PASS
			VN	50	-15.24	-0.02	±2.5	PASS
GSM850	GPRS	MCH	VN	-10	-15.17	-0.02	±2.5	PASS
			VN	0	-15.30	-0.02	±2.5	PASS
			VN	10	-15.88	-0.02	±2.5	PASS
			VN	20	-17.37	-0.02	±2.5	PASS
			VN	30	-12.20	-0.01	±2.5	PASS
			VN	40	-14.08	-0.02	±2.5	PASS
			VN	50	-16.08	-0.02	±2.5	PASS
GSM850	GPRS	HCH	VN	-10	-16.08	-0.02	±2.5	PASS
			VN	0	-12.91	-0.02	±2.5	PASS
			VN	10	-13.88	-0.02	±2.5	PASS
			VN	20	-17.11	-0.02	±2.5	PASS
			VN	30	-12.27	-0.01	±2.5	PASS
			VN	40	-13.95	-0.02	±2.5	PASS
			VN	50	-15.63	-0.02	±2.5	PASS

Test Band	Test Mode	Test Channel	Test Volt.	Test Tem. (℃)	Freq.Error (Hz)	Freq.vs.rated (ppm)	Limit (ppm)	Verdict
PCS 1900	GSM	LCH	VN	-10	-27.31	-0.01	±2.5	PASS
			VN	0	-28.35	-0.02	±2.5	PASS
			VN	10	-26.73	-0.01	±2.5	PASS
			VN	20	-27.31	-0.01	±2.5	PASS
			VN	30	-31.51	-0.02	±2.5	PASS
			VN	40	-26.47	-0.01	±2.5	PASS
			VN	50	-27.57	-0.01	±2.5	PASS
PCS 1900	GSM	MCH	VN	-10	-26.99	-0.01	±2.5	PASS
			VN	0	-31.64	-0.02	±2.5	PASS
			VN	10	-32.16	-0.02	±2.5	PASS
			VN	20	-29.96	-0.02	±2.5	PASS
			VN	30	-32.67	-0.02	±2.5	PASS
			VN	40	-26.73	-0.01	±2.5	PASS
			VN	50	-34.16	-0.02	±2.5	PASS
PCS 1900	GSM	HCH	VN	-10	-30.22	-0.02	±2.5	PASS
			VN	0	-27.44	-0.01	±2.5	PASS
			VN	10	-30.09	-0.02	±2.5	PASS
			VN	20	-32.16	-0.02	±2.5	PASS
			VN	30	-33.77	-0.02	±2.5	PASS
			VN	40	-32.61	-0.02	±2.5	PASS
			VN	50	-31.12	-0.02	±2.5	PASS

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

RADIATED SPURIOUS EMISSION



RADIATED SPURIOUS ABOVE 1G EMISSION

----END OF REPORT----