

# CERTIFICATION TEST REPORT

**Report Number.** : 4790976580-E3V1

**Applicant** : SAMSUNG ELECTRONICS CO., LTD.  
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,  
GYEONGGI-DO, 16677, KOREA

**Model** : SC-51E, SCG25

**FCC ID** : A3LSMS921JPN

**EUT Description** : GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax,  
NFC and WPT.

**Test Standard(s)** : FCC 47 CFR PART 24 SUBPART E

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Revision History

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SAMSUNG ELECTRONICS CO., LTD.

**EUT DESCRIPTION:** GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC and WPT.

**MODEL NUMBER:** SC-51E, SCG25

**SERIAL NUMBER:** R3CWB0FGXJP, R3CWB0FGWHA (CONDUCTED);  
R3CWB0FGWVN, R3CWB0FGW7E (RADIATED);

**DATE TESTED:** 2023-12-13 - 2024-01-19;

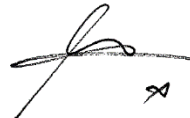
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 24E	Complies

UL KOREA LTD. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL KOREA LTD. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and Modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL KOREA LTD. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL KOREA LTD. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For  
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Tested By:



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## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC 47 CFR Part 2.
2. FCC 47 CFR Part 24.
3. ANSI TIA-603-E, 2016
4. ANSI C63.26, 2015
5. KDB 971168 D01 Power Meas License Digital Systems v03r01
6. KDB 971168 D02 Misc Rev Approv License Devices v02r02
7. KDB 412172 D01 Determining ERP and EIRP v01r01

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro	
<input checked="" type="checkbox"/>	Chamber 1(3m semi-anechoic chamber)
<input checked="" type="checkbox"/>	Chamber 2(3m semi-anechoic chamber)
<input type="checkbox"/>	Chamber 3(3m semi-anechoic chamber)
<input checked="" type="checkbox"/>	Chamber 4(3m Full-anechoic chamber)
<input type="checkbox"/>	Chamber 5(3m Full-anechoic chamber)

UL KOREA LTD. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\text{EIRP} = \text{PSA reading with EUT worst orientation (dBm)} + \text{Path loss (dB)} - \text{cable loss (between the SG and substitution antenna)} + \text{Substitution Antenna Factor (dBi)}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.80 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.92 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.06 dB
Radiated Disturbance, 18 GHz to 40 GHz	6.02 dB

Uncertainty figures are valid to a confidence level of 95%.

### 4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2021.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC and WPT. This test report addresses the WWAN operational mode.

Representative model	Difference	Derivative model
		SCG25
SC-51E	Hardware	Same as SC-51E
	Software	Different UI

The model SC-51E was used for final testing and is representative of the test results in this report.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum average radiated EIRP output powers as follows: Radiated samples were set to a higher power than conducted resulting in radiated EIRP greater than conducted measurements.

#### GSM

FCC Part 24							
Band	ANT	Frequency Range [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
GSM 1900	A	1850.20 ~ 1909.80	GPRS	29.35	860.99	28.44	698.23
			EGPRS	25.78	378.44	25.71	372.39

#### LTE Band 2

FCC Part 24								
Band	ANT	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 2	A	1860.00 ~ 1900.00	20	QPSK	23.47	222.33	23.42	219.79
				16QAM	22.76	188.80	22.60	181.97
				64QAM	21.88	154.17		
		1857.50 ~ 1902.50	15	QPSK	23.67	232.81	23.81	240.44
				16QAM	22.94	196.79	22.97	198.15
				64QAM	21.98	157.76		
		1855.00 ~ 1905.00	10	QPSK	23.66	232.27	23.79	239.33
				16QAM	22.95	197.24	22.97	198.15
				64QAM	21.91	155.24		
		1852.50 ~ 1907.50	5	QPSK	23.41	219.28	23.52	224.91
				16QAM	22.70	186.21	22.73	187.50
				64QAM	21.98	157.76		
		1851.50 ~ 1908.50	3	QPSK	23.40	218.78	23.61	229.61
				16QAM	22.70	186.21	22.77	189.23
				64QAM	21.98	157.76		
		1850.70 ~ 1909.30	1.4	QPSK	23.59	228.56	23.78	238.78
				16QAM	22.74	187.93	22.82	191.43
				64QAM	21.86	153.46		

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a internal antenna for the supported bands with a maximum peak gain as follow:

Frequency (MHz)	ANT	Peak Gain (dBi)
GSM 1900 / LTE Band 2 1850 - 1910 MHz	A	-3.0

### 5.4. WORST-CASE ORIENTATION

Following Modes should be considered as worst-case scenario for all other measurements.

- GSM GPRS/EGPRS

For LTE Band 2 the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM, 64QAM modulations. It was found QPSK and 16QAM results were worst case.

- Conducted Spurious Emission

Highest conducted power setting for each bands					
LTE Band	ANT	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
2	A	1857.50	15	1	37
		1880.00		1	74
		1902.50		1	0

- Radiated Spurious Emission

Highest EIRP setting for each bands					
LTE Band	ANT	Frequency (MHz)	Bandwidth (MHz)	RB size	RB offset
2	A	1857.50	15	1	37
		1880.00		1	74
		1902.50		1	0

The fundamental and radiated spurious emission were investigated in three orthogonal orientations X, Y and Z, it was determined that below orientation was worst-case orientation for each band.

Band	ANT	EIRP			RSE		
		X	Y	Z	X	Y	Z
GSM 1900	A	O	-	-	-	-	O
LTE B2	A	O	-	-	O	-	-

Note : For the radiated spurious testing, the EUT attached with travel adapter for the worst case condition. The EUT is continuously communicated with the call box during the tests.



## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacture	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37W61WENTASEA	N/A
Data Cable	SAMSUNG	EP-DN980	GH39-02117A	N/A

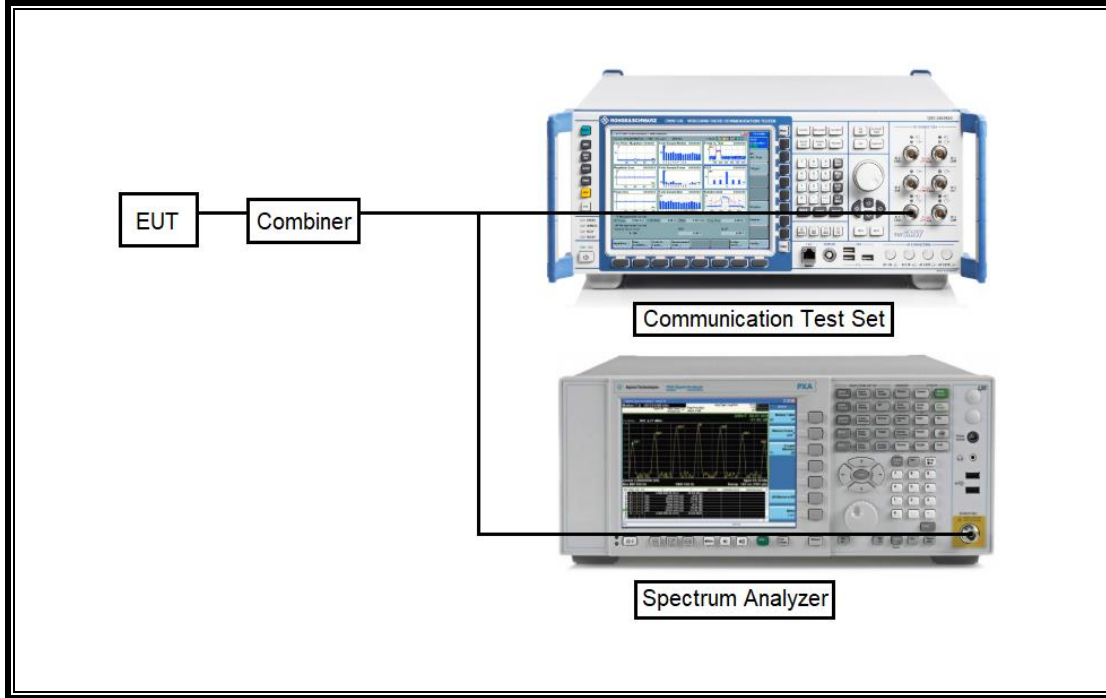
### I/O CABLE

I/O Cable List						
Cable No.	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	C Type	Shielded	1.0 m	N/A

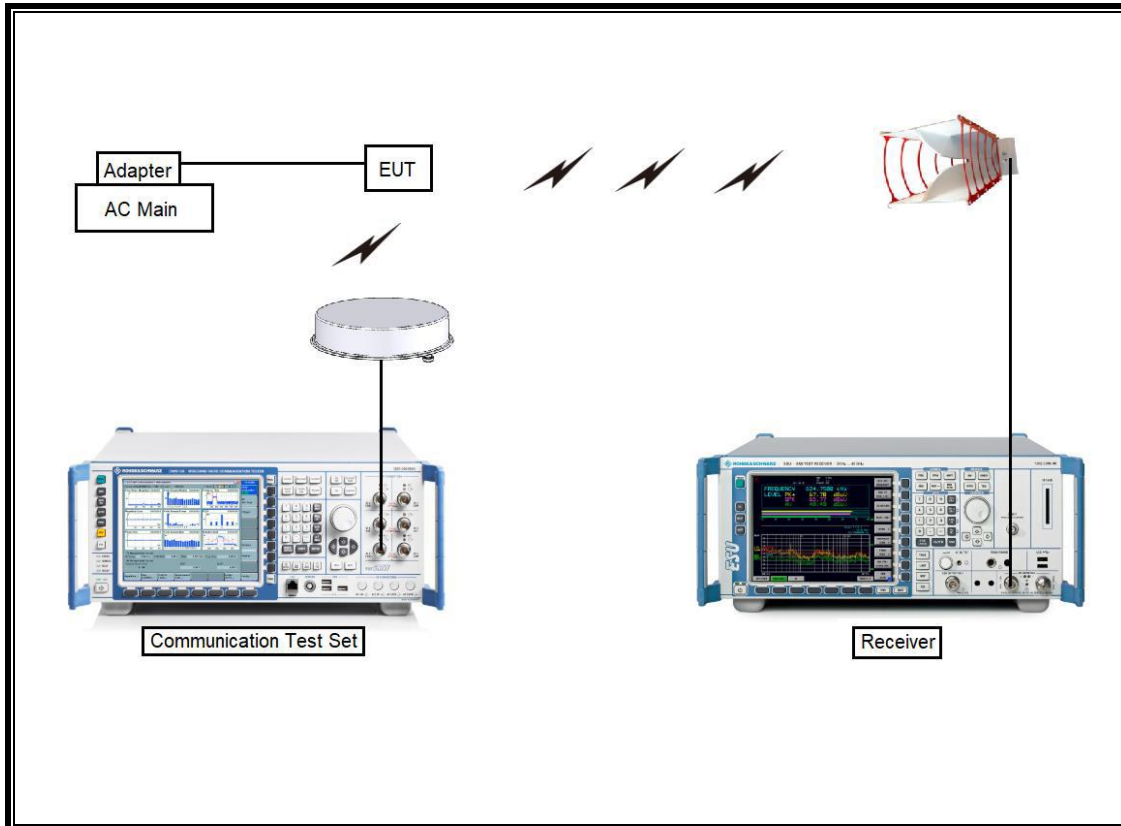
### TEST SETUP

The EUT is continuously communicated with the call box during the tests.

**SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)**



**SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121D DB4	00164753	2025-01-17
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	110367-0003	N/A
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	80108-0004	N/A
Antenna, Horn, 40 GHz	ETS	3116C	00166155	2024-08-02
Antenna, Horn, 40 GHz	ETS	3116C	00168645	2025-10-05
Preamplifier	ETS	3115-PA	00167475	2024-07-25
Preamplifier	ETS	3116C-PA	00168841	2024-07-25
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2024-08-15
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2024-08-15
Antenna, Horn, 18 GHz	ETS	3115	00167211	2024-08-04
Antenna, Horn, 18 GHz	ETS	3115	00161451	2024-08-21
Antenna, Horn, 18 GHz	ETS	3117	00168724	2024-08-04
Antenna, Horn, 18 GHz	ETS	3117	00168717	2024-08-21
Communications Test Set	R&S	CMW500	169797	2024-07-23
DC Power Supply	Agilent / HP	E3640A	MY54226395	2024-07-24
Preamplifier, 1000 MHz	Sonoma	310N	341282	2024-07-24
Preamplifier, 1000 MHz	Sonoma	310N	370599	2024-07-24
Preamplifier, 1000 MHz	Sonoma	310N	351741	2024-07-24
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	2024-07-24
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2024-07-25
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2024-07-25
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2024-07-24
Spectrum Analyzer, 44 GHz	KEYSIGHT	N9030B	MY57143717	2024-07-24
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2024-07-23
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2024-07-24
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	2024-07-23
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	2024-07-23
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	2024-07-24
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	2024-07-24
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	2024-07-24
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	2024-07-24
Attenuator	PASTERNAK	PE7087-10	A009	2024-07-24
Attenuator	PASTERNAK	PE7087-10	A001	2024-07-24
Attenuator	PASTERNAK	PE7087-10	A008	2024-07-27
Attenuator	PASTERNAK	PE7004-10	2	2024-07-23
Attenuator	PASTERNAK	PE7395-10	A011	2024-07-25
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2025-09-06
Temperature Chamber	ESPEC	SH-642	93001109	2024-07-24
Power Splitter	MINI-CIRCUITS	WA1534	UL003	2025-01-02
Power Splitter	MINI-CIRCUITS	WA1534	UL004	2025-01-02
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	MY57510655	2025-01-03
UL Software				
Description	Manufacturer	Model	Version	
Antenna port test software	UL	CLT	Ver 3.4	
Radiated software	UL	UL EMC	Ver 9.5	
Antenna port test software (5G NR FR1)	UL	UL iM	Ver 1.06	

## 7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Results
2.1046	Conducted Output Power	N/A	Conducted	Pass
2.1049	Occupied Bandwidth (99%)	N/A		Pass
24.238(a)	Conducted Band Edge / Conducted Spurious Emission	-13 dBm		Pass
24.235	Frequency Stability	2.5 ppm	Radiated	Pass
24.232(c)	Effective Isotropic Radiated Power	33 dBm		Pass
24.238(a)	Radiated Spurious Emission	-13 dBm		Pass

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## 8. CONDUCTED RESULTS

### 8.1. CONDUCTED OUTPUT POWER

#### Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to CMW500 Test Set and configured to operate at maximum power.

#### RESULTS

See the following pages.

### 8.1.1. CONDUCTED AVERAGE OUTPUT POWER

#### GSM 1900

Mode	Coding Scheme	Time Slots	Maximum Average Power (dBm)			
			Measured		Tune-up Limit	
			Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr
GSM (Voice)	CS1	1	28.89	19.70	30.0	21.0
			29.35	20.16		
			28.98	19.79		
GPRS (GMSK)	CS1	1	28.90	19.71	30.0	21.0
			29.26	20.07		
			29.03	19.84		
		2	27.59	21.41	29.0	23.0
			28.03	21.85		
			27.84	21.66		
		3	26.31	21.89	27.5	23.2
			26.04	21.62		
			25.20	20.78		
		4	24.33	21.16	25.5	22.5
			24.61	21.44		
			24.53	21.36		
EGPRS (8PSK)	MCS5	1	25.28	16.09	27.0	18.0
			25.78	16.59		
			25.61	16.42		
		2	24.09	17.91	25.0	19.0
			24.73	18.55		
			24.55	18.37		
		3	23.28	18.86	24.5	20.2
			23.97	19.55		
			23.76	19.34		
		4	22.93	19.76	24.5	21.5
			23.65	20.48		
			23.48	20.31		

**LTE Band 2**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				Measured Pwr (dBm)			MPR	Tune-up Limit
				18700 1860.00 MHz	18900 1880.00 MHz	19100 1900.00 MHz		
20 MHz	QPSK	1	0	22.39	23.06	23.37	0.0	24.2
		1	49	23.47	23.42	23.38	0.0	24.2
		1	99	23.36	23.38	23.36	0.0	24.2
		50	0	22.46	22.52	22.45	1.0	23.2
		50	24	22.54	22.51	22.44	1.0	23.2
		50	50	22.42	22.45	22.34	1.0	23.2
	16QAM	100	0	22.43	22.47	22.42	1.0	23.2
		1	0	22.33	22.19	22.67	1.0	23.2
		1	49	22.69	22.76	22.67	1.0	23.2
		1	99	22.64	22.72	22.66	1.0	23.2
		50	0	21.51	21.51	21.48	2.0	22.2
		50	24	21.51	21.53	21.49	2.0	22.2
	64QAM	50	50	21.47	21.48	21.36	2.0	22.2
		100	0	21.47	21.47	21.46	2.0	22.2
		1	0	21.52	21.36	21.59	2.0	22.2
		1	49	21.67	21.70	21.88	2.0	22.2
		1	99	21.60	21.65	21.84	2.0	22.2
		50	0	20.47	20.50	20.50	3.0	21.2
15 MHz	QPSK	50	24	20.48	20.51	20.53	3.0	21.2
		50	50	20.40	20.46	20.42	3.0	21.2
		100	0	20.45	20.50	20.51	3.0	21.2
		1	0	21.84	22.23	23.67	0.0	24.2
		1	37	21.85	23.08	23.41	0.0	24.2
		1	74	21.83	23.39	22.74	0.0	24.2
	16QAM	36	0	22.53	22.63	22.70	1.0	23.2
		36	20	22.63	22.64	22.73	1.0	23.2
		36	39	22.56	22.63	22.61	1.0	23.2
		75	0	22.57	22.58	22.66	1.0	23.2
		1	0	20.92	21.42	22.94	1.0	23.2
		1	37	21.03	22.36	22.78	1.0	23.2
	64QAM	1	74	21.04	22.71	22.27	1.0	23.2
		36	0	21.56	21.67	21.72	2.0	22.2
		36	20	21.67	21.69	21.75	2.0	22.2
		36	39	21.60	21.64	21.62	2.0	22.2
		75	0	21.59	21.61	21.70	2.0	22.2
		1	0	21.72	21.10	21.82	2.0	22.2
QPSK	1	37	21.79	21.98	21.88	2.0	22.2	
	1	74	21.77	21.89	21.81	2.0	22.2	
	36	0	20.58	20.57	20.64	3.0	21.2	
	36	20	20.66	20.56	20.67	3.0	21.2	
	36	39	20.63	20.56	20.55	3.0	21.2	
	75	0	20.65	20.55	20.63	3.0	21.2	

BW (MHz)	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
				18650	18900	19150		
				1855.00 MHz	1880.00 MHz	1905.00 MHz		
10 MHz	QPSK	1	0	21.85	22.65	23.66	0.0	24.2
		1	25	22.05	23.20	23.29	0.0	24.2
		1	49	21.81	23.38	22.90	0.0	24.2
		25	0	22.61	22.61	22.68	1.0	23.2
		25	12	22.69	22.64	22.70	1.0	23.2
		25	25	22.64	22.60	22.59	1.0	23.2
	16QAM	50	0	22.63	22.60	22.68	1.0	23.2
		1	0	20.89	21.79	22.95	1.0	23.2
		1	25	21.18	22.39	22.66	1.0	23.2
		1	49	21.01	22.64	22.30	1.0	23.2
		25	0	21.67	21.63	21.72	2.0	22.2
		25	12	21.73	21.68	21.74	2.0	22.2
	64QAM	25	25	21.67	21.63	21.67	2.0	22.2
		50	0	21.65	21.63	21.71	2.0	22.2
		1	0	21.65	21.52	21.84	2.0	22.2
		1	25	21.80	21.91	21.89	2.0	22.2
		1	49	21.58	21.83	21.81	2.0	22.2
		25	0	20.67	20.64	20.65	3.0	21.2
5 MHz	QPSK	25	12	20.74	20.69	20.67	3.0	21.2
		25	25	20.67	20.64	20.55	3.0	21.2
		50	0	20.67	20.64	20.64	3.0	21.2
		1	0	21.88	23.01	23.41	0.0	24.2
		1	12	22.10	23.22	23.27	0.0	24.2
		1	24	22.02	23.28	22.89	0.0	24.2
	16QAM	12	0	22.55	22.59	22.67	1.0	23.2
		12	7	22.69	22.65	22.69	1.0	23.2
		12	13	22.67	22.63	22.69	1.0	23.2
		25	0	22.61	22.60	22.68	1.0	23.2
		1	0	21.23	22.38	22.60	1.0	23.2
		1	12	21.51	22.65	22.59	1.0	23.2
	64QAM	1	24	21.40	22.70	22.20	1.0	23.2
		12	0	21.59	21.76	21.68	2.0	22.2
		12	7	21.72	21.81	21.73	2.0	22.2
		12	13	21.71	21.76	21.71	2.0	22.2
		25	0	21.66	21.62	21.69	2.0	22.2
		1	0	21.94	21.80	21.75	2.0	22.2
64QAM	1	12	21.18	21.98	21.85	2.0	22.2	
	1	24	21.03	21.79	21.75	2.0	22.2	
	12	0	20.68	20.71	20.64	3.0	21.2	
	12	7	20.80	20.80	20.68	3.0	21.2	
	12	13	20.79	20.75	20.64	3.0	21.2	
	25	0	20.65	20.65	20.64	3.0	21.2	



## 8.2. PEAK TO AVERAGE RATIO

### Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to CMW500 Test Set and configured to operate at maximum power. The PAR were measured on the Spectrum Analyzer.

### Test Spec

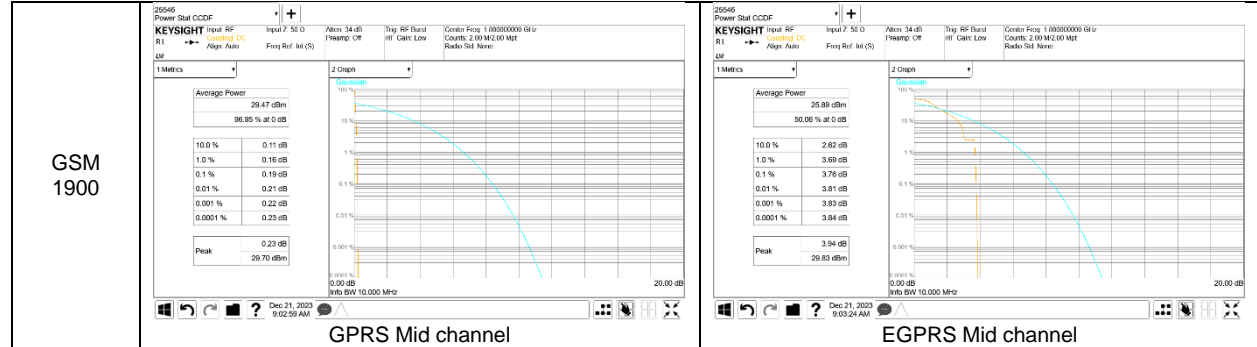
In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

### RESULTS

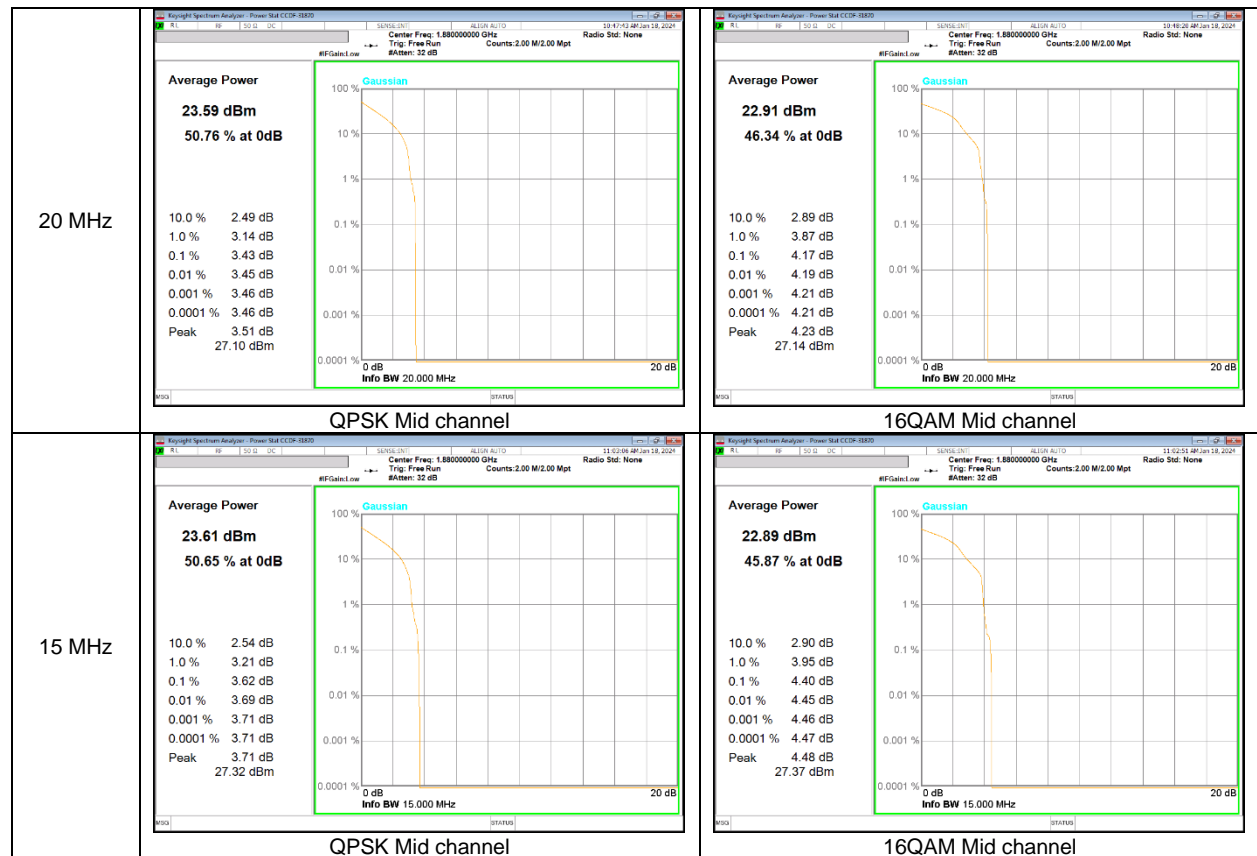
See the following pages.

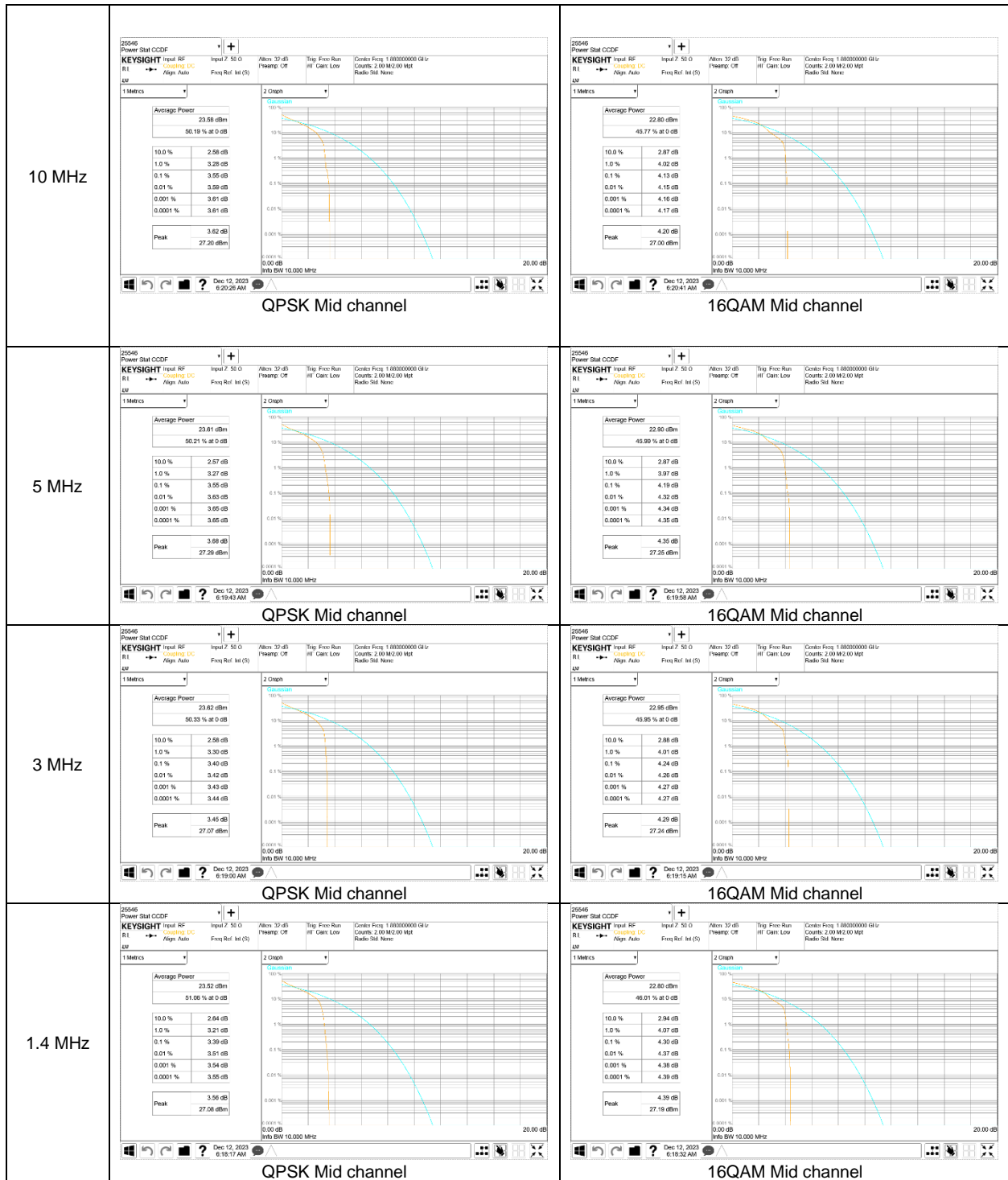
### 8.2.1. CONDUCTED PEAK TO AVERAGE RESULTS

#### GSM



#### LTE Band 2





### **8.3. OCCUPIED BANDWIDTH**

#### **RULE PART(S)**

FCC: §2.1049

#### **LIMITS**

For reporting purposes only

#### **TEST PROCEDURE**

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at middle channel in each band. The -26dB bandwidth was also measured and recorded.

(KDB 971168 D01 Power Meas License Digital Systems v03r01)

#### **RESULTS**

See the following pages.

**- GSM**

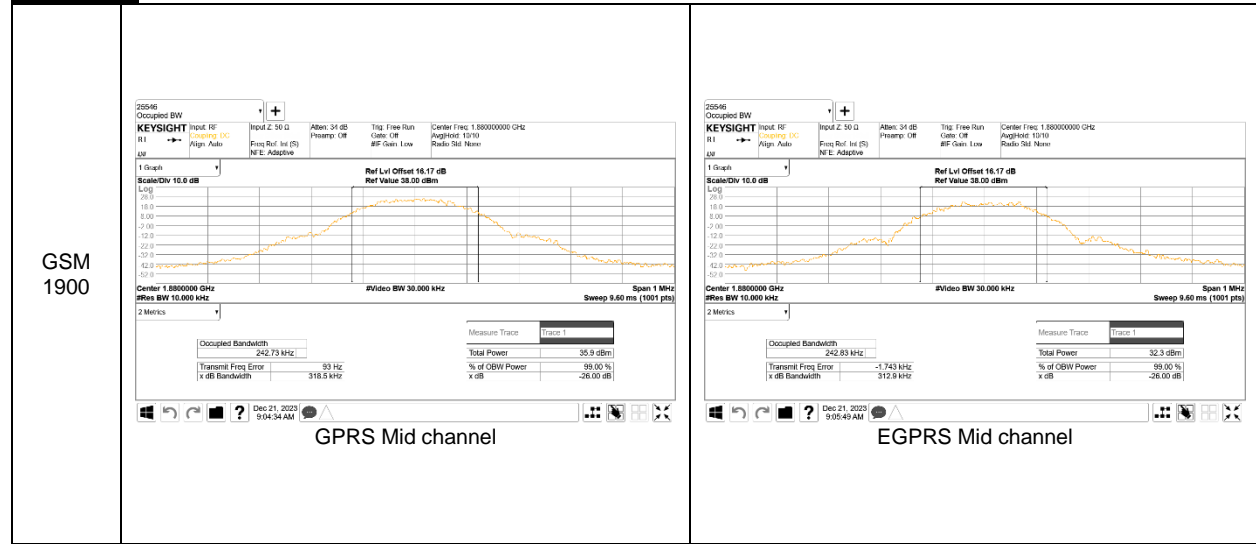
Band	Modulation	f [MHz]	99% BW (kHz)	-26dB BW (kHz)
1900	GPRS	1880.0	242.73	318.5
	EGPRS		242.83	312.9

**- LTE Band 2**

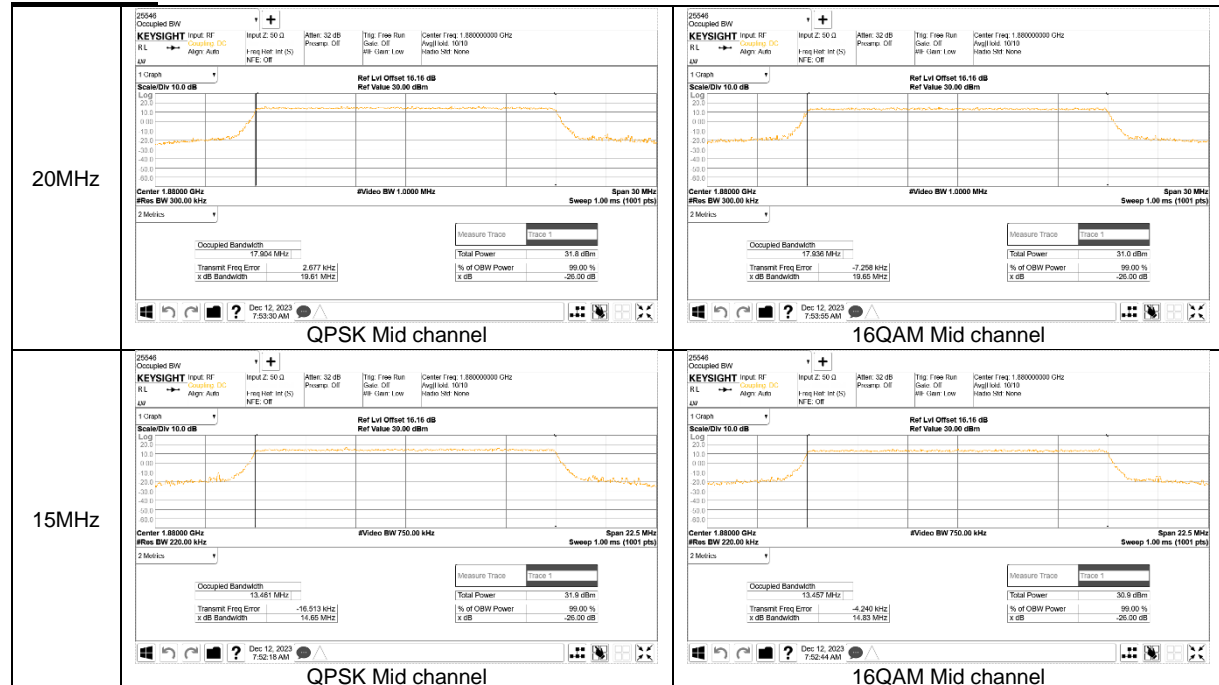
Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B2	20M	QPSK	1880.00	17.904	19.61
		16QAM		17.936	19.65
	15M	QPSK		13.461	14.65
		16QAM		13.457	14.83
	10M	QPSK		8.973	9.959
		16QAM		8.985	9.836
	5M	QPSK		4.497	5.142
		16QAM		4.499	5.060
	3M	QPSK		2.701	3.045
		16QAM		2.706	3.065
	1.4M	QPSK		1.093	1.371
		16QAM		1.096	1.396

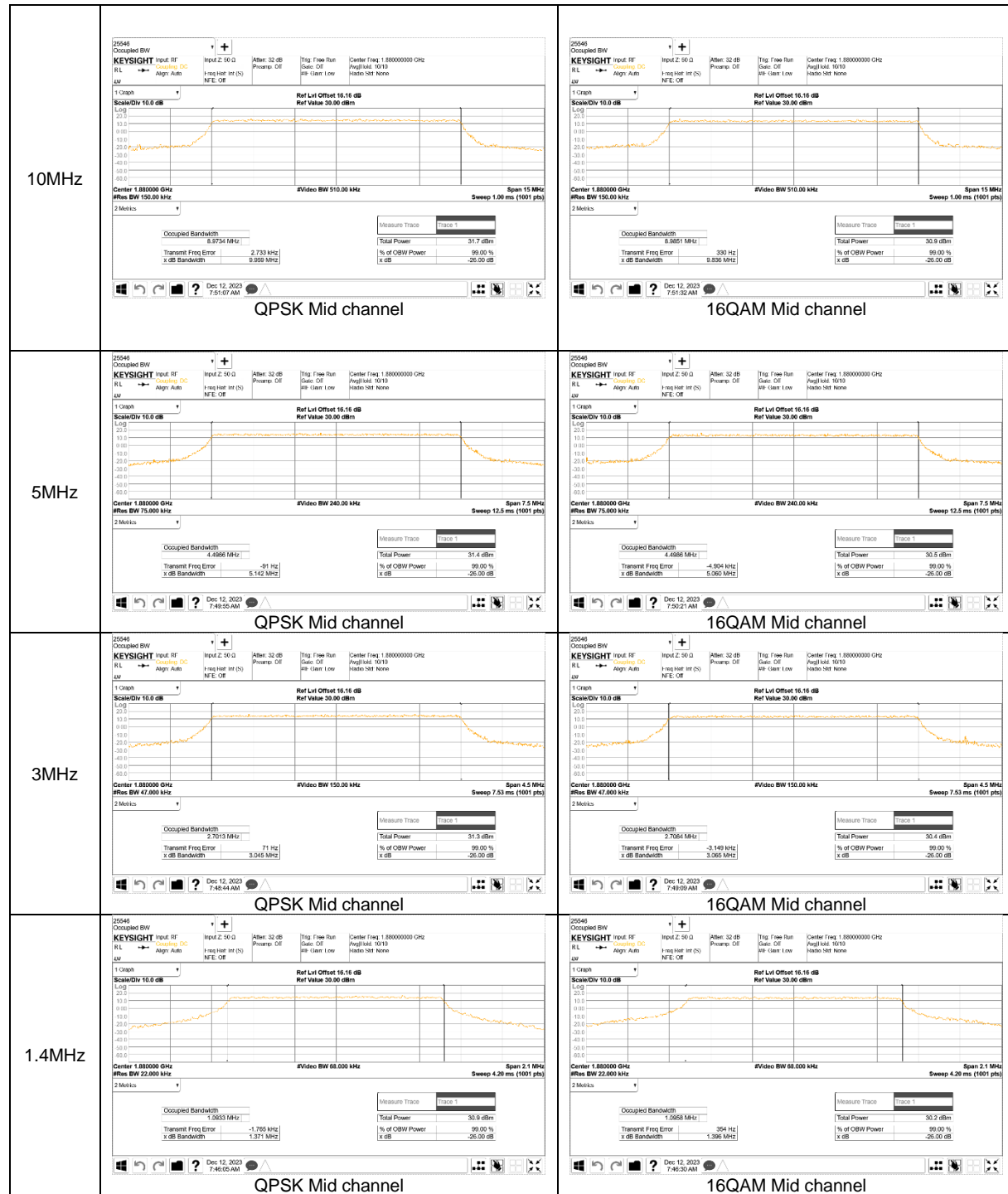
### 8.3.1. OCCUPIED BANDWIDTH RESULTS

#### GSM 1900



#### LTE Band 2





## 8.4. BAND EDGE EMISSIONS

### RULE PART(S)

FCC: §24.238

### LIMITS

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

### TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

The transmitter output was connected to CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

### GSM

- a) Set the RBW = 1 - 5% of OBW(GSM1900 – 9.1kHz)
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 1.5$  times the OBW;
- d) Sweep time = 1S ;
- e) Detector = RMS;
- f) Ensure that the number of measurement points  $\geq 2 \times$  Span/RBW;
- g) Trace Mode = Average(100);
- h) Add duty cycle correction factor (9dB)

### LTE

- a) Set the RBW = 1 - 1.5 % of OBW(Typically limited to a minimum RBW of 1% of the OBW)
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 1.5$  times the OBW;
- d) Sweep time = Auto;
- e) Detector = RMS;
- f) Ensure that the number of measurement points  $\geq 2 \times$  Span/RBW;
- g) Trace Mode = Average (100);



**NOTE1**

Note that the spurious emissions outside of the channel include narrowband signals. These signals are all below the -13dBm limits. Although the measurement bandwidth is less than the reference bandwidth of 1MHz no addental correction is applied as ANSI C63.26 section 4.2.3 only requires the correction to be applied when the OBW of the emission being measured is wider than the measurement bandwidth (Where the OBW of the signal under measurement is less than the RBW of the measuring instrument, no bandwidth correction or integration will be required.) Plots for low and high channels show the level of the emission measured with the reduced bandwidth and the level of the same emission measured using the integration method over the 1MHz reference bandwidth are very close, indicating the emissions are narrowband.

**NOTE2**

For Band-Edge extended:

CH BW (MHz)	RB Used (kHz)	CF for emissions more than 100kHz	CF for emissions more than 1MHz
1.4	15	+8.2 dB	+18.2 dB
3	30	+5.2 dB	+15.2 dB
5	51	+2.9 dB	+12.9 dB
10	100	N/A	+10.0 dB
15	150	N/A	+8.2 dB
20	200	N/A	+7.0 dB

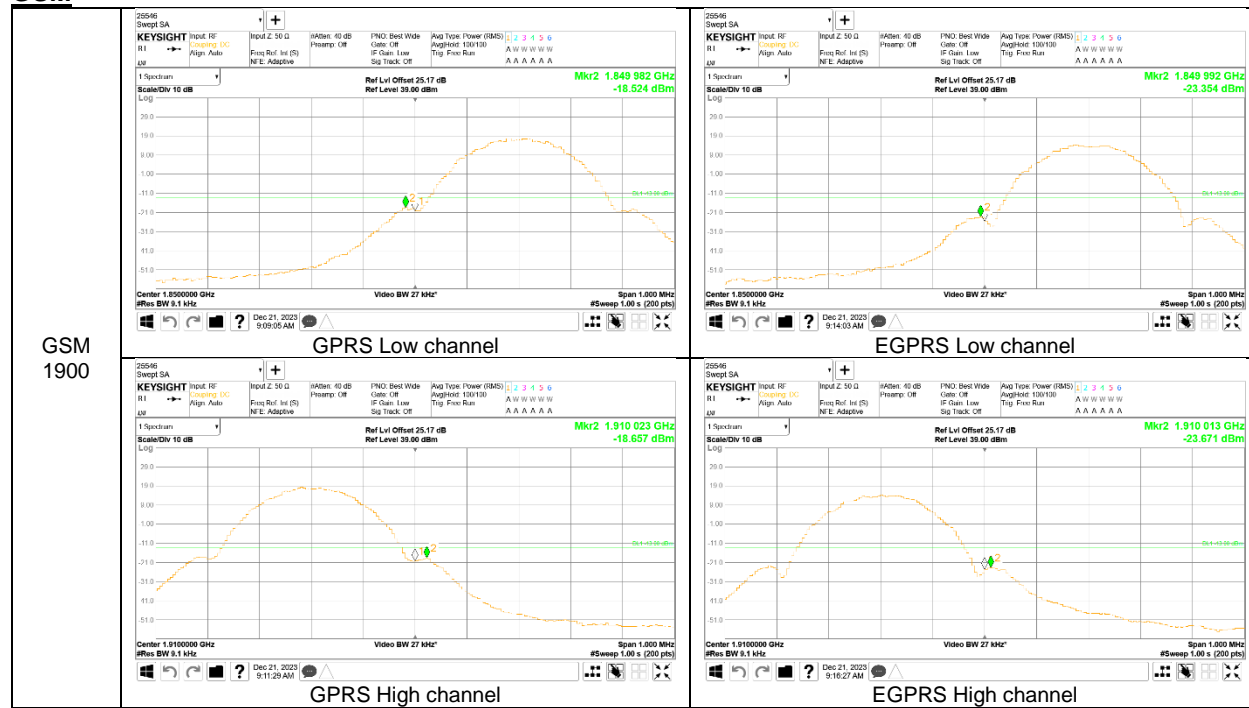
For the band edge value measured in [RB Used], even if [CF for emissions reference bandwidth 100kHz/1MHz] is applied, it is below -13dBm.

**RESULTS**

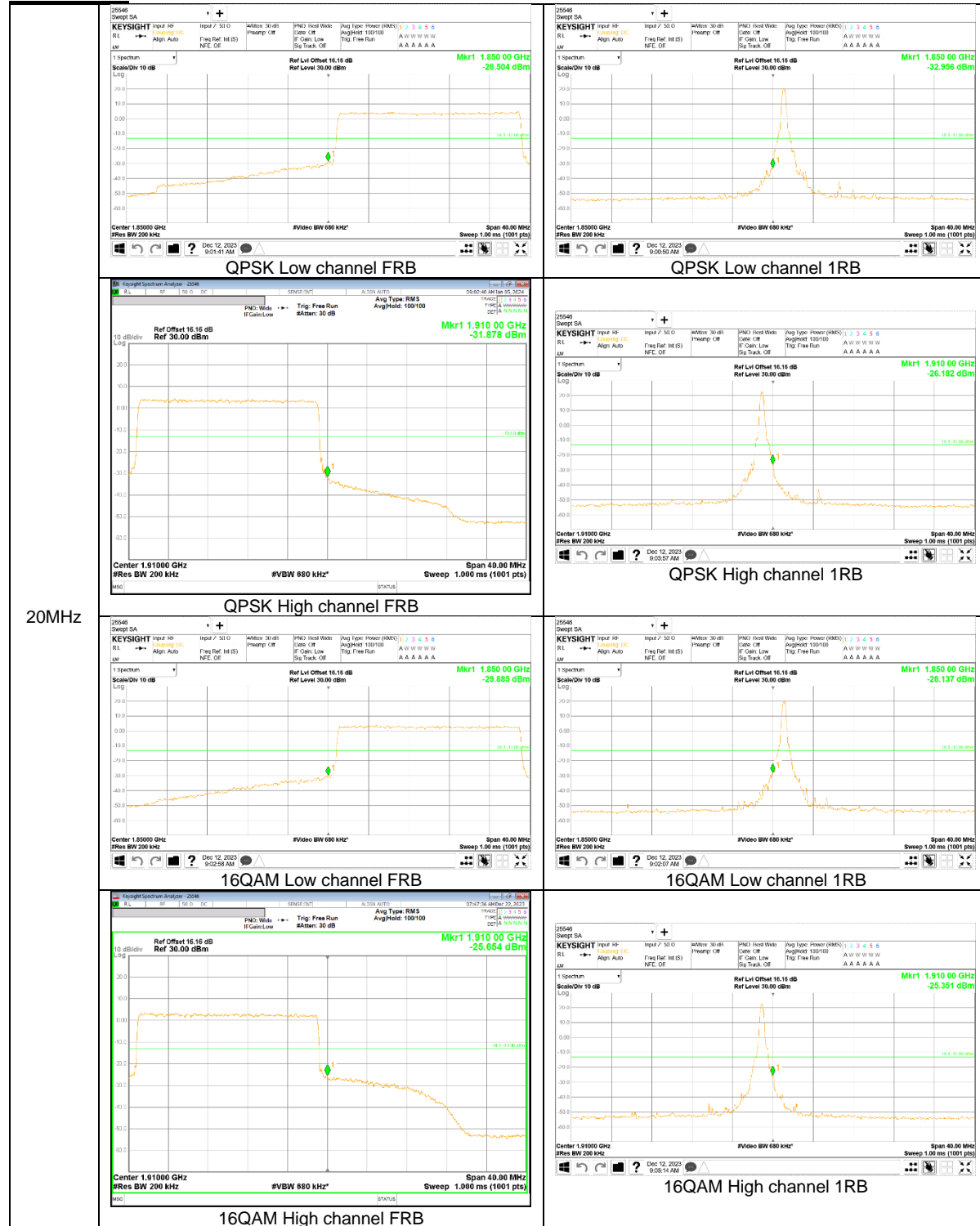
See the following pages.

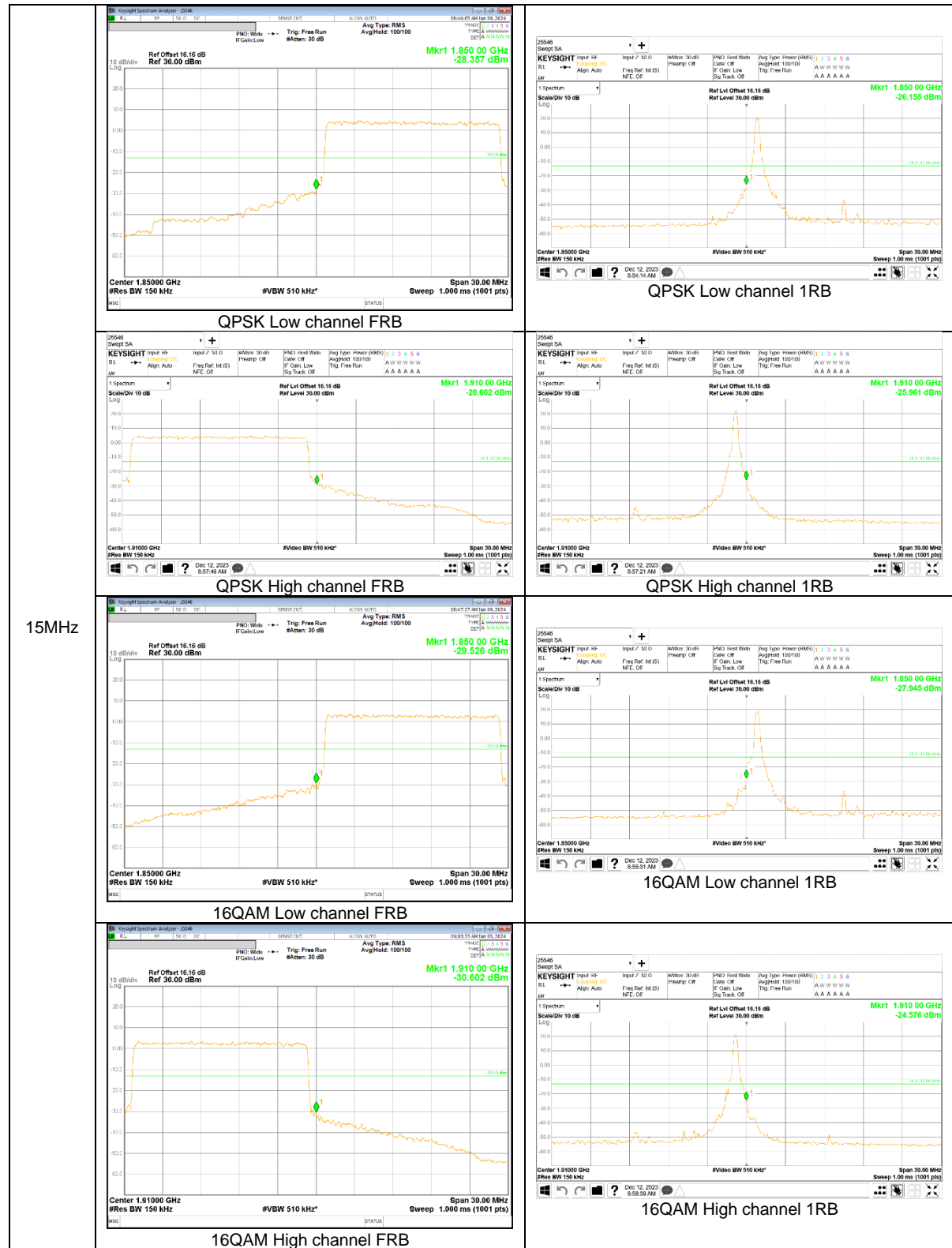
### 8.4.1. BAND EDGE RESULTS

#### GSM

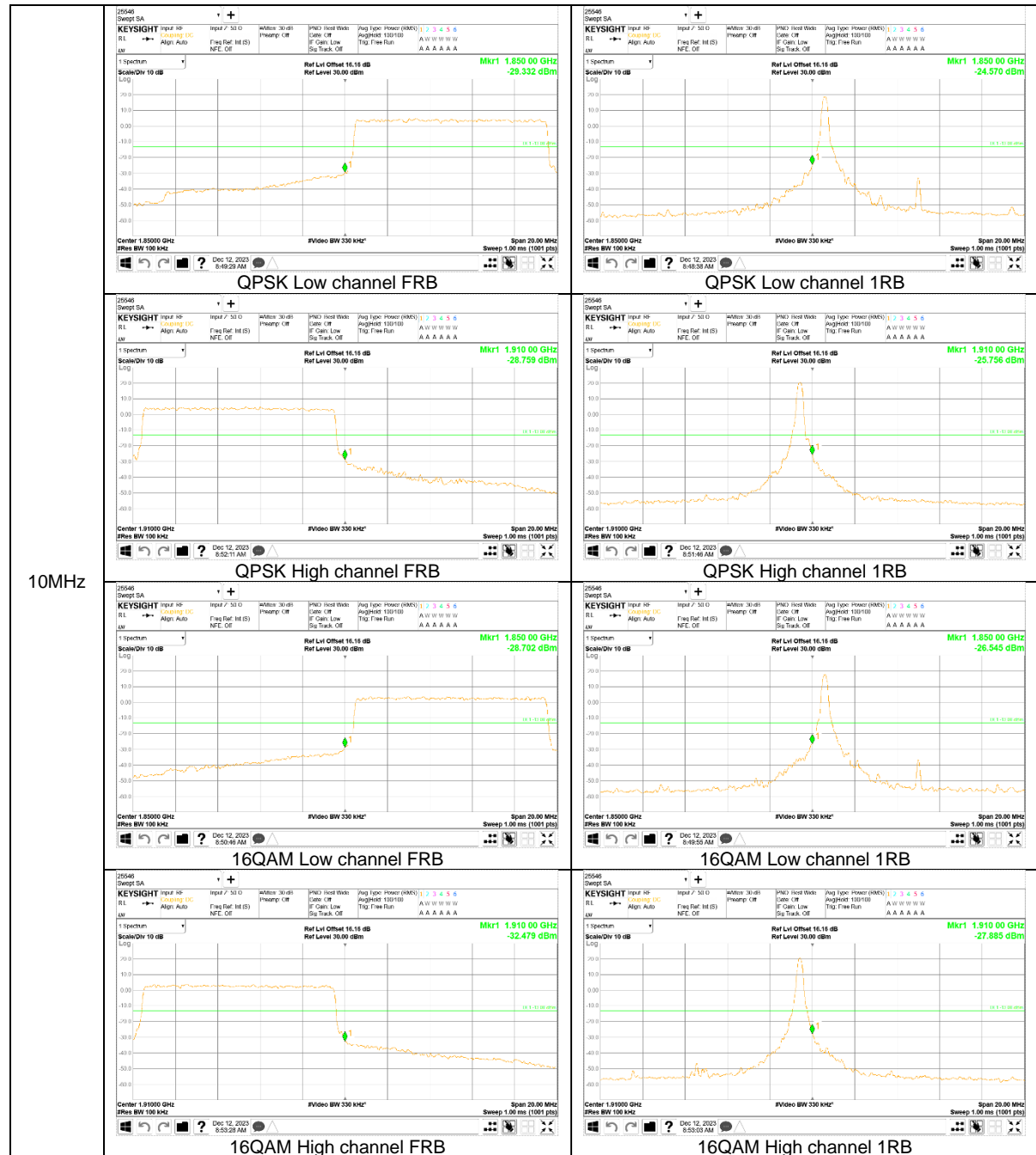


LTE Band 2

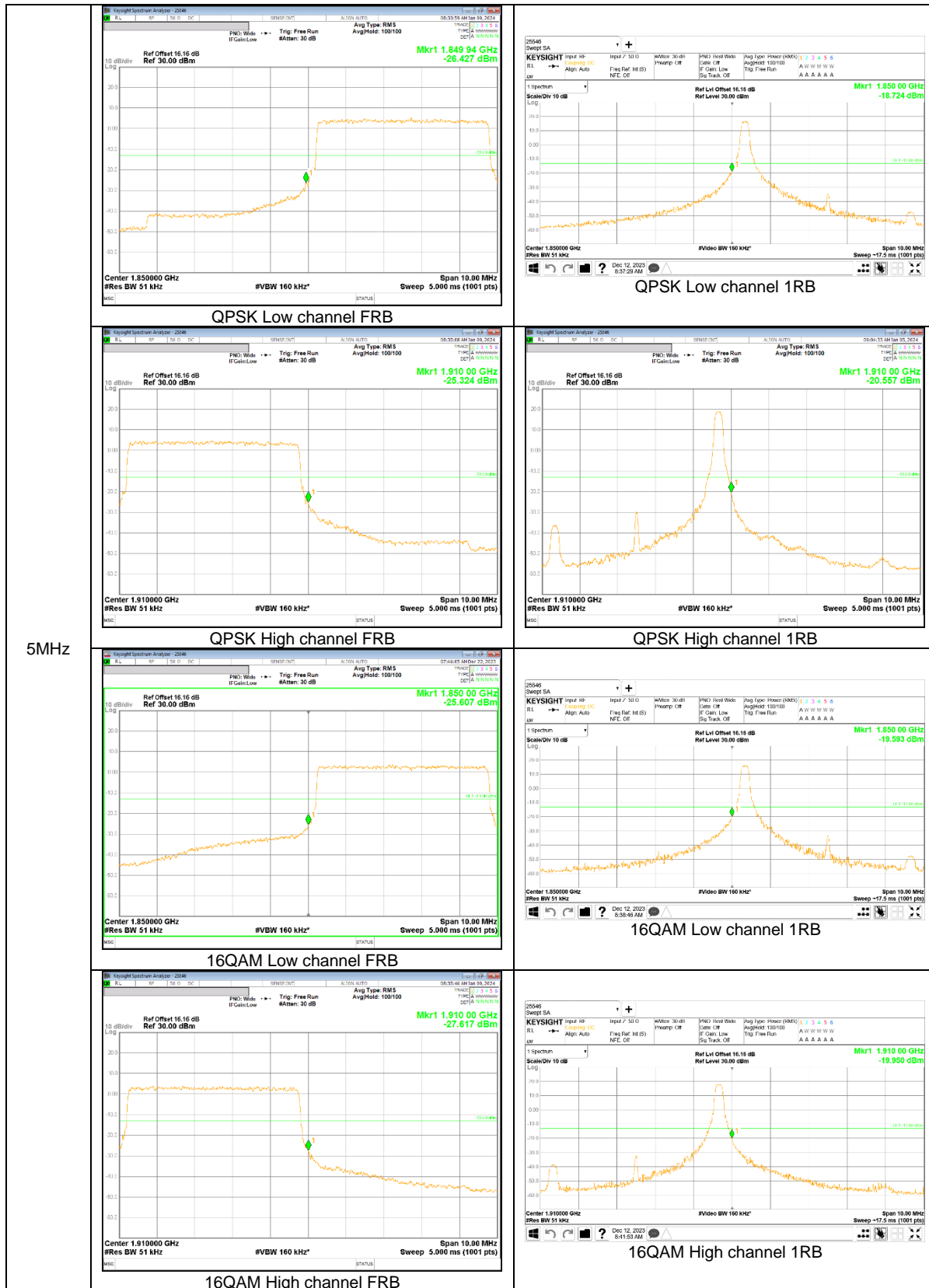


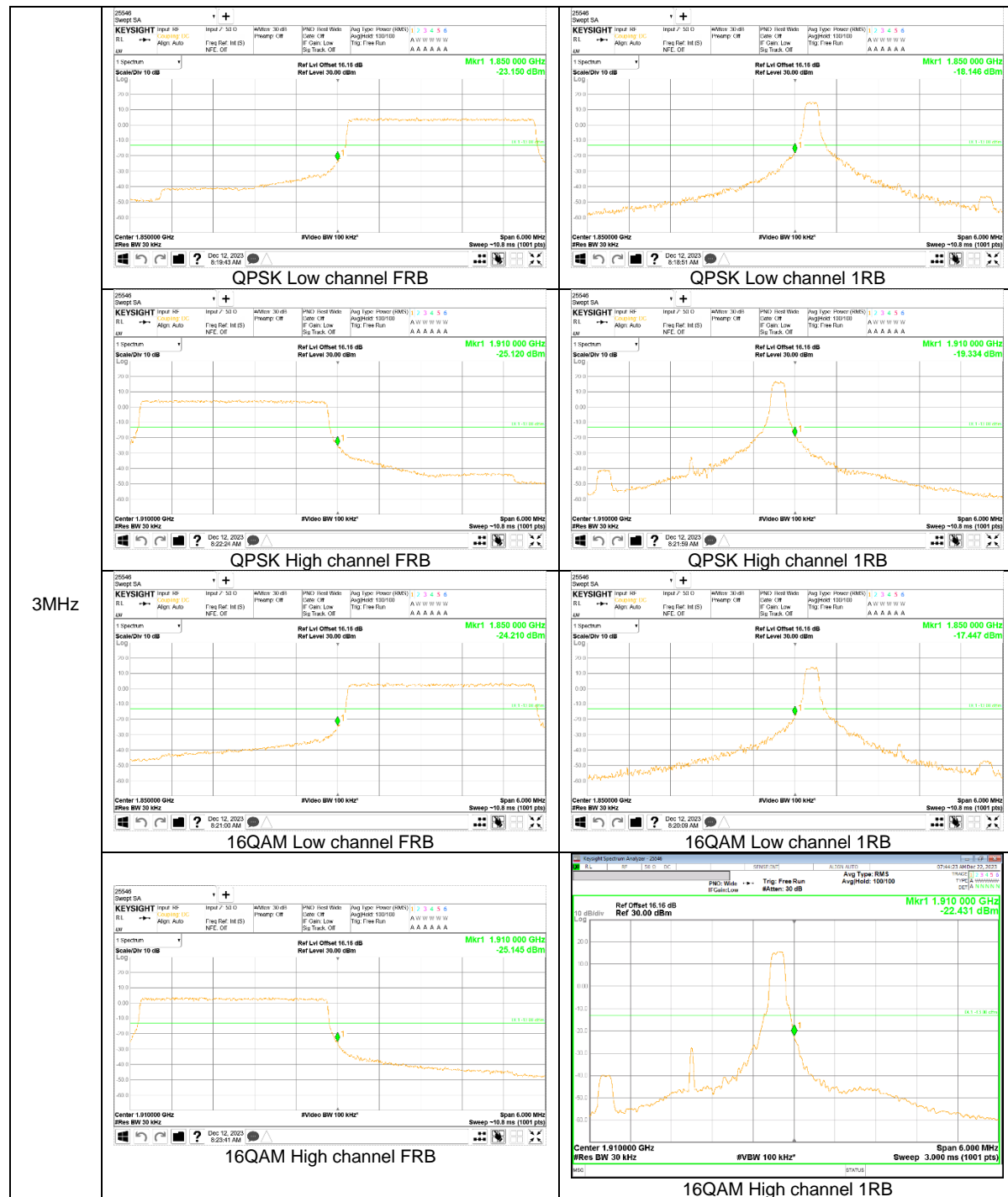


15MHz

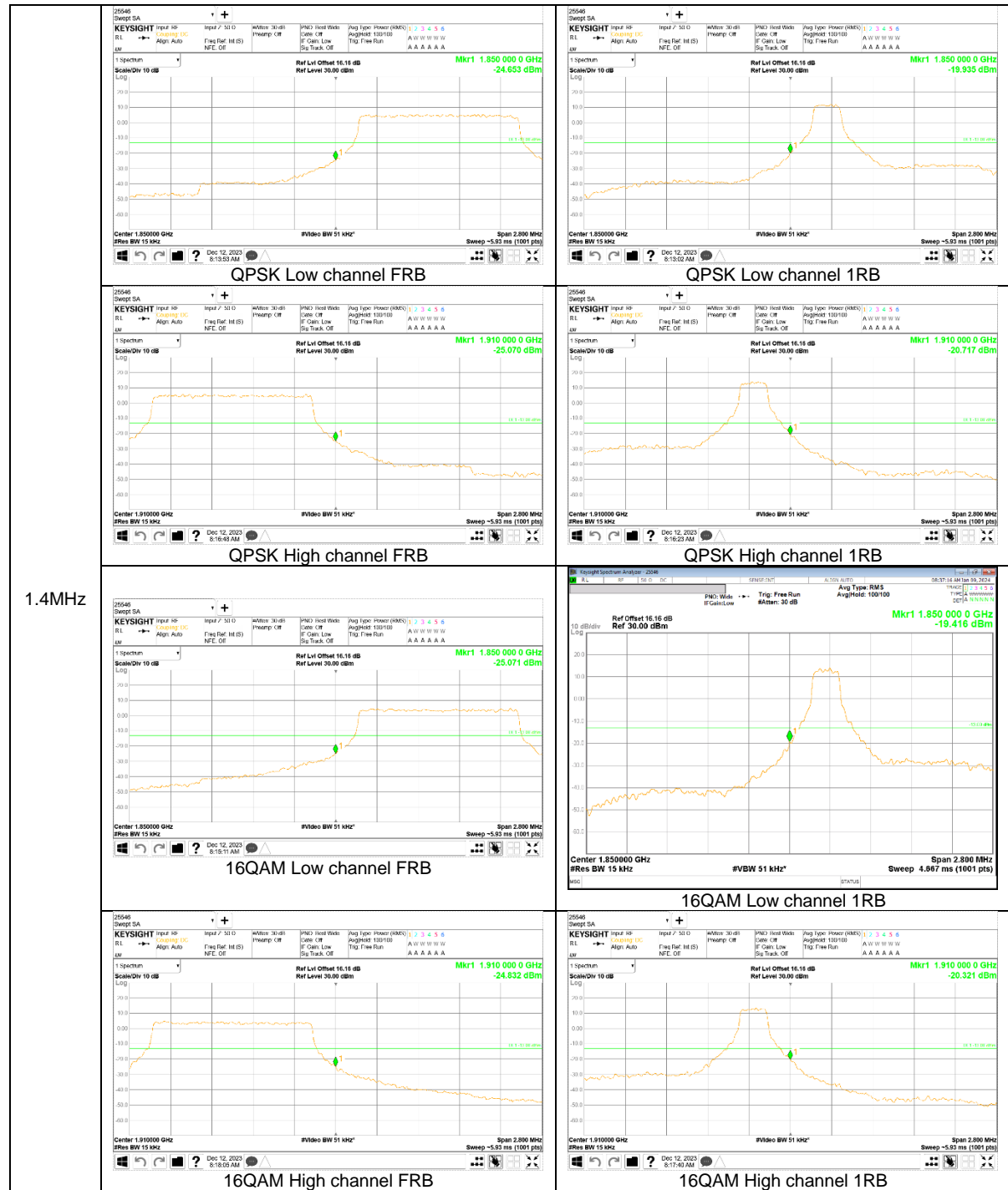


10MHz





3MHz





## 8.5. CONDUCTED SPURIOUS EMISSIONS

### RULE PART(S)

FCC: §2.1051, §24.238

### LIMITS

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

### TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold Mode using a peak detector to ensure that the worst-case emissions were caught.

- a) Set the RBW = 1 MHz for emissions above 1 GHz  
(Tests were performed 1MHz [Worst case], to sweep 1 time for all frequency range)
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 1.5$  times the OBW;
- d) Sweep time = auto couple;
- e) Detector = rms;
- f) Ensure that the number of measurement points = Max (40001);
- g) Trace Mode = average(LTE), Max hold(GSM);

### NOTE1

Please refer to section 5.4 for bandwidth and RB setting about LTE bands.

### RESULTS

See the following pages.

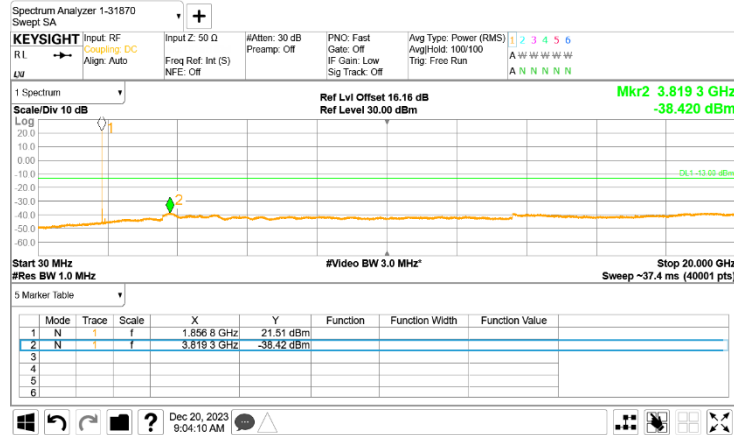
### 8.5.1. OUT OF BAND EMISSIONS RESULTS

#### GSM 1900



**LTE Band 2**

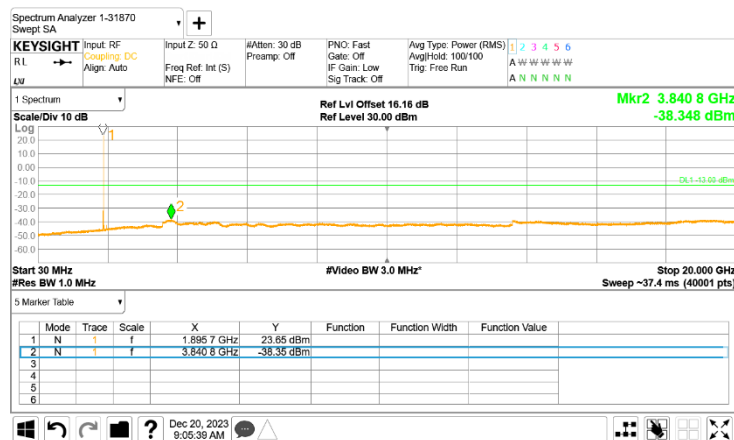
15MHz QPSK



Low channel



Mid channel



High channel

## **8.6. FREQUENCY STABILITY**

### **RULE PART(S)**

FCC: §2.1055, §24.235

### **LIMITS**

24.235

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

### **TEST PROCEDURE**

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

### **NOTE**

Test were performed each lowest or highest frequency on the modulation condition of more wide bandwidth.(Please refer to section 9.1.1 OBW results)

### **RESULTS**

See the following pages.

**8.6.1. FREQUENCY STABILITY RESULTS**

**GSM 1900, Channel 512/810, Frequency 1850.0/1910.0 MHz  
 (Lowest Frequency:GPRS / Highest Frequency: EGPRS)**

Test Date	2023-12-18
Test Engineer	25546

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1850.0737	1909.9203		
Extreme (50C)		1850.0737	1909.9203	13.3	0.007
Extreme (40C)		1850.0737	1909.9203	10.1	0.005
Extreme (30C)		1850.0737	1909.9203	5.5	0.003
Extreme (10C)		1850.0737	1909.9203	7.7	0.004
Extreme (0C)		1850.0737	1909.9203	9.4	0.005
Extreme (-10C)		1850.0737	1909.9203	12.0	0.006
Extreme (-20C)		1850.0737	1909.9203	13.3	0.007
Extreme (-30C)		1850.0737	1909.9203	11.5	0.006
20C		15%	1850.0737	1909.9203	12.3
	-15%	1850.0737	1909.9203	11.2	0.006
	End Point	1850.0737	1909.9203	15.4	0.008

**LTE Band 2 (Lowest Frequency: 16QAM / Highest Frequency: 16QAM)**

Test Date	2023-12-19
Test Engineer	25546

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1850.1524	1909.8483		
Extreme (50C)		1850.1524	1909.8483	35.5	0.019
Extreme (40C)		1850.1524	1909.8483	42.3	0.022
Extreme (30C)		1850.1524	1909.8483	32.4	0.017
Extreme (10C)		1850.1524	1909.8483	35.7	0.019
Extreme (0C)		1850.1524	1909.8483	38.4	0.020
Extreme (-10C)		1850.1524	1909.8483	40.4	0.021
Extreme (-20C)		1850.1524	1909.8483	32.7	0.017
Extreme (-30C)		1850.1524	1909.8483	36.6	0.019
20C		15%	1850.1524	1909.8483	33.4
	-15%	1850.1524	1909.8483	34.6	0.018
	End Point	1850.1524	1909.8483	27.4	0.015

## 9. RADIATED RESULTS

### 9.1. RADIATED POWER (EIRP)

#### RULE PART(S)

FCC: §2.1046, §24.232

#### LIMITS

24.232(c)

Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

#### TEST PROCEDURE

ANSI / TIA / EIA 603 E Clause 2.2.17; ESU40 setting reference to 971168 D01 v03r01

For radiated output power measurement with a ESU40:

- a) Set the RBW  $\geq$  OBW;
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 2 \times$  OBW;
- d) Sweep time = auto couple or 1 second;
- e) Detector = rms;
- f) Ensure that the number of measurement points  $\geq$  span/RBW;
- g) Trace Mode = max hold(GSM), average(LTE);

#### TEST RESULTS

See the following pages.

### 9.1.1. EIRP Results

#### GSM (ANT A)

Band	Mode	Frequency (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	Limit (dBm)	Delta (dB)
GSM 1900	GPRS	1850.20	22.31	H	4.48	9.52	27.35	543.25	33.00	-5.65
		1880.00	23.55	H	4.52	9.29	28.31	677.64	33.00	-4.69
		1909.80	23.99	H	4.55	9.00	28.44	698.23	33.00	-4.56
	EGPRS	1850.20	19.68	H	4.48	9.52	24.72	296.48	33.00	-8.28
		1880.00	20.84	H	4.52	9.29	25.60	363.08	33.00	-7.40
		1909.80	21.26	H	4.55	9.00	25.71	372.39	33.00	-7.29

#### LTE Band 2 (ANT A)

BW (MHz)	Modulation	Frequency (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	Limit (dBm)	Delta (dB)	RB
20	QPSK	1860.00	17.69	H	4.49	9.45	22.65	184.08	33.00	-10.35	1/49
		1880.00	18.56	H	4.52	9.29	23.32	214.78	33.00	-9.68	1/49
		1900.00	18.82	H	4.54	9.13	23.42	219.79	33.00	-9.58	1/49
	16-QAM	1860.00	16.91	H	4.49	9.45	21.87	153.82	33.00	-11.13	1/49
		1880.00	17.62	H	4.52	9.29	22.38	172.98	33.00	-10.62	1/49
		1900.00	18.00	H	4.54	9.13	22.60	181.97	33.00	-10.40	1/49
15	QPSK	1857.50	16.83	H	4.49	9.47	21.81	151.71	33.00	-11.19	1/37
		1880.00	18.53	H	4.52	9.29	23.29	213.30	33.00	-9.71	1/74
		1902.50	19.26	H	4.54	9.10	23.81	240.44	33.00	-9.19	1/10
	16-QAM	1857.50	15.87	H	4.49	9.47	20.85	121.62	33.00	-12.15	1/74
		1880.00	17.57	H	4.52	9.29	22.33	171.00	33.00	-10.67	1/74
		1902.50	18.42	H	4.54	9.10	22.97	198.15	33.00	-10.03	1/10
10	QPSK	1855.00	16.79	H	4.49	9.48	21.79	151.01	33.00	-11.21	1/25
		1880.00	18.52	H	4.52	9.29	23.28	212.81	33.00	-9.72	1/49
		1905.00	19.27	H	4.55	9.06	23.79	239.33	33.00	-9.21	1/10
	16-QAM	1855.00	15.83	H	4.49	9.48	20.83	121.06	33.00	-12.17	1/25
		1880.00	17.50	H	4.52	9.29	22.26	168.27	33.00	-10.74	1/49
		1905.00	18.45	H	4.55	9.06	22.97	198.15	33.00	-10.03	1/10
5	QPSK	1852.50	16.75	H	4.49	9.50	21.77	150.31	33.00	-11.23	1/12
		1880.00	18.42	H	4.52	9.29	23.18	207.97	33.00	-9.82	1/24
		1907.50	19.04	H	4.55	9.03	23.52	224.91	33.00	-9.48	1/10
	16-QAM	1852.50	15.78	H	4.49	9.50	20.80	120.23	33.00	-12.20	1/12
		1880.00	17.56	H	4.52	9.29	22.32	170.61	33.00	-10.68	1/24
		1907.50	18.25	H	4.55	9.03	22.73	187.50	33.00	-10.27	1/10
3	QPSK	1851.50	16.68	H	4.49	9.51	21.71	148.25	33.00	-11.29	1/14
		1880.00	18.54	H	4.52	9.29	23.30	213.80	33.00	-9.70	1/14
		1908.50	19.14	H	4.55	9.02	23.61	229.61	33.00	-9.39	1/10
	16-QAM	1851.50	15.73	H	4.49	9.51	20.76	119.12	33.00	-12.24	1/14
		1880.00	17.54	H	4.52	9.29	22.30	169.82	33.00	-10.70	1/14
		1908.50	18.30	H	4.55	9.02	22.77	189.23	33.00	-10.23	1/10
1.4	QPSK	1850.70	17.52	H	4.48	9.52	22.56	180.30	33.00	-10.44	1/10
		1880.00	18.71	H	4.52	9.29	23.47	222.33	33.00	-9.53	1/10
		1909.30	19.32	H	4.55	9.00	23.78	238.78	33.00	-9.22	1/10
	16-QAM	1850.70	16.71	H	4.48	9.52	21.75	149.62	33.00	-11.25	1/5
		1880.00	17.60	H	4.52	9.29	22.36	172.19	33.00	-10.64	1/3
		1909.30	18.36	H	4.55	9.00	22.82	191.43	33.00	-10.18	1/10

## 9.2. RADIATED SPURIOUS EMISSION

### RULE PART(S)

FCC: §2.1053, §24.238

### LIMIT

24.238(a)

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

### TEST PROCEDURE

ANSI / TIA / EIA 603 E Clause 2.2.12; ESU40 setting reference to 971168 D01 v03r01

For peak power measurement with a ESU40:

- a) Set the RBW = 1 MHz for emissions above 1 GHz
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 1.5$  times the OBW;
- d) Sweep time = auto couple;
- e) Detector = rms;
- f) Ensure that the number of measurement points  $\geq$  span/RBW;
- g) Trace Mode = average(LTE), Maxhold(GSM);

### NOTE

Please refer to section 5.4 for bandwidth and RB setting about LTE bands.

### RESULTS

See the following pages.



### 9.2.1. SPURIOUS RADIATION RESULTS

#### GSM1900

UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement									
Company:		Samsung							
Project #:		4790976580							
Date:		2023-12-21							
Test Engineer:		26460							
Configuration:		EUT, Z-Position							
Location:		Chamber 2							
Mode:		GPRS 1900 MHz Harmonics							
Test Votage:		AC 120 V, 60 Hz							
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
GPRS									
ANT A									
Low Ch, 1850.2MHz									
3700.40	-9.6	V	3.0	42.2	1.0	-50.8	-13.0	-37.8	
5550.60	-6.5	V	3.0	43.0	1.0	-48.5	-13.0	-35.5	
7400.80	-4.1	V	3.0	42.6	1.0	-45.7	-13.0	-32.7	
3700.40	-9.7	H	3.0	42.2	1.0	-50.9	-13.0	-37.9	
5550.60	-6.4	H	3.0	43.0	1.0	-48.4	-13.0	-35.4	
7400.80	-4.7	H	3.0	42.6	1.0	-46.3	-13.0	-33.3	
Mid Ch, 1880MHz									
3760.00	-9.4	V	3.0	42.2	1.0	-50.6	-13.0	-37.6	
5640.00	-4.9	V	3.0	43.1	1.0	-46.9	-13.0	-33.9	
7520.00	-4.1	V	3.0	42.6	1.0	-45.7	-13.0	-32.7	
3760.00	-9.5	H	3.0	42.2	1.0	-50.7	-13.0	-37.7	
5640.00	-4.1	H	3.0	43.1	1.0	-46.2	-13.0	-33.2	
7520.00	-4.7	H	3.0	42.6	1.0	-46.3	-13.0	-33.3	
High Ch, 1909.8MHz									
3819.60	-9.3	V	3.0	42.2	1.0	-50.5	-13.0	-37.5	
5729.40	-5.0	V	3.0	43.1	1.0	-47.0	-13.0	-34.0	
7639.20	-3.9	V	3.0	42.5	1.0	-45.5	-13.0	-32.5	
3819.60	-9.4	H	3.0	42.2	1.0	-50.6	-13.0	-37.6	
5729.40	-4.4	H	3.0	43.1	1.0	-46.5	-13.0	-33.5	
7639.20	-4.7	H	3.0	42.5	1.0	-46.2	-13.0	-33.2	

**LTE Band 2**

UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement									
<b>Company:</b>		Samsung							
<b>Project #:</b>		4790976580							
<b>Date:</b>		2023-12-15							
<b>Test Engineer:</b>		28775							
<b>Configuration:</b>		EUT / AC Adapter, X-Position							
<b>Location:</b>		Chamber 1							
<b>Mode:</b>		LTE_QPSK Band 2 Harmonics, 15MHz Bandwidth							
<b>Test Votage:</b>		AC 120 V, 60 Hz							
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
<b>15 MHz</b>									
<b>QPSK</b>									
<b>ANT A</b>									
<b>Low Ch, 1857.5MHz</b>									
3715.00	-9.1	V	3.0	44.1	1.0	-52.2	-13.0	-39.2	
5572.50	-6.5	V	3.0	45.0	1.0	-50.5	-13.0	-37.5	
7430.00	-3.8	V	3.0	45.0	1.0	-47.8	-13.0	-34.8	
3715.00	-8.9	H	3.0	44.1	1.0	-52.0	-13.0	-39.0	
5572.50	-6.4	H	3.0	45.0	1.0	-50.4	-13.0	-37.4	
7430.00	-3.7	H	3.0	45.0	1.0	-47.7	-13.0	-34.7	
<b>Mid Ch, 1880MHz</b>									
3760.00	-8.9	V	3.0	44.1	1.0	-52.1	-13.0	-39.1	
5640.00	-6.2	V	3.0	45.0	1.0	-50.2	-13.0	-37.2	
7520.00	-3.8	V	3.0	44.9	1.0	-47.7	-13.0	-34.7	
3760.00	-8.6	H	3.0	44.1	1.0	-51.8	-13.0	-38.8	
5640.00	-6.0	H	3.0	45.0	1.0	-50.0	-13.0	-37.0	
7520.00	-3.7	H	3.0	44.9	1.0	-47.7	-13.0	-34.7	
<b>High Ch, 1902.5MHz</b>									
3805.00	-8.7	V	3.0	44.2	1.0	-51.9	-13.0	-38.9	
5707.50	-6.3	V	3.0	45.0	1.0	-50.3	-13.0	-37.3	
7610.00	-3.4	V	3.0	44.9	1.0	-47.3	-13.0	-34.3	
3805.00	-8.6	H	3.0	44.2	1.0	-51.7	-13.0	-38.7	
5707.50	-6.1	H	3.0	45.0	1.0	-50.2	-13.0	-37.2	
7610.00	-3.3	H	3.0	44.9	1.0	-47.2	-13.0	-34.2	

**END OF REPORT**