

## 8.5. CONDUCTED SPURIOUS EMISSIONS

### RULE PART(S)

FCC: §2.1051, §22.901, §22.917 and 90.691

### 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.

Part 90.691(a):

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

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \text{Log}_{10}(P)$  decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz. (NOTE : Use 100kHz reference bandwidth)

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

### 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 = 100 kHz for emission below 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(WCDMA, LTE, 5G NR), Max hold(GSM);

### NOTE1

5G NR: All Waveforms (CP-OFDM vs DFT-s\_OFDM) and modulations ( $\pi/2$  BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

### NOTE2

Please refer to section 5.4 for bandwidth and RB setting about LTE, 5G NR bands.

### RESULTS

See the following pages.

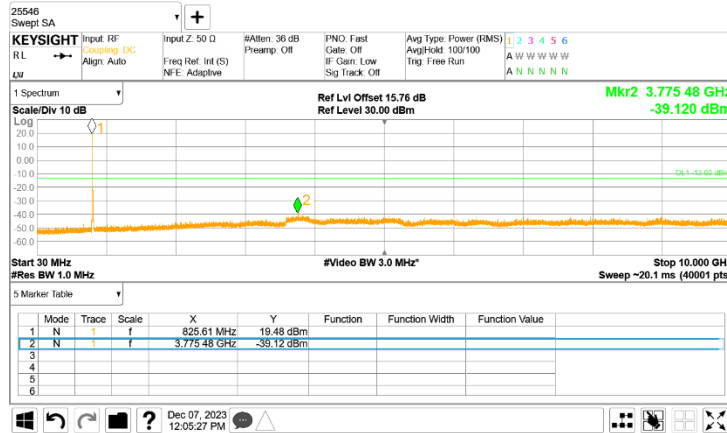
### 8.5.1. OUT OF BAND EMISSIONS RESULTS

#### GSM 850

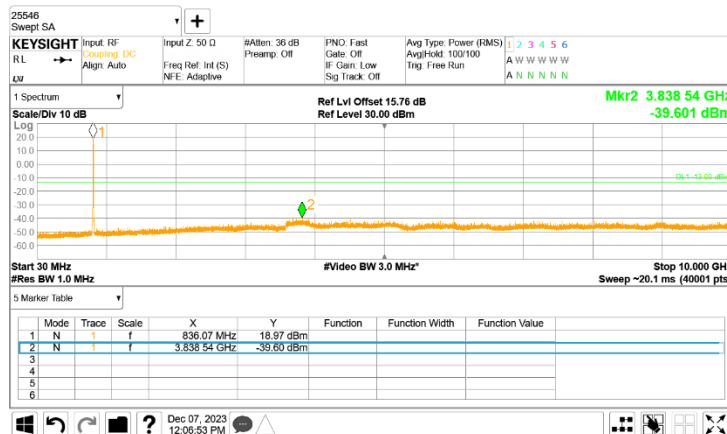


**WCDMA Band 5**

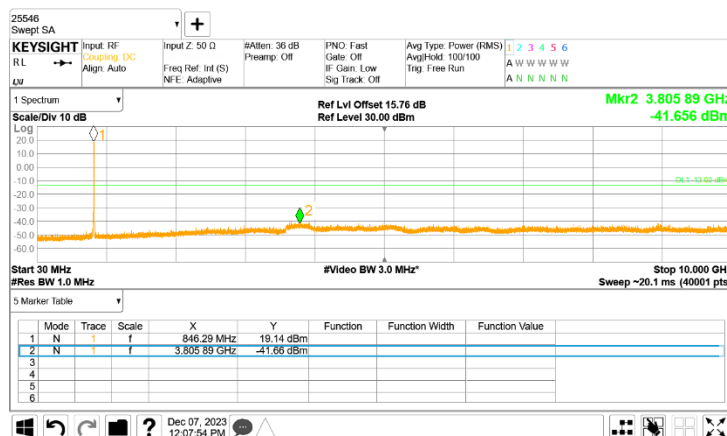
REL 99



Low channel



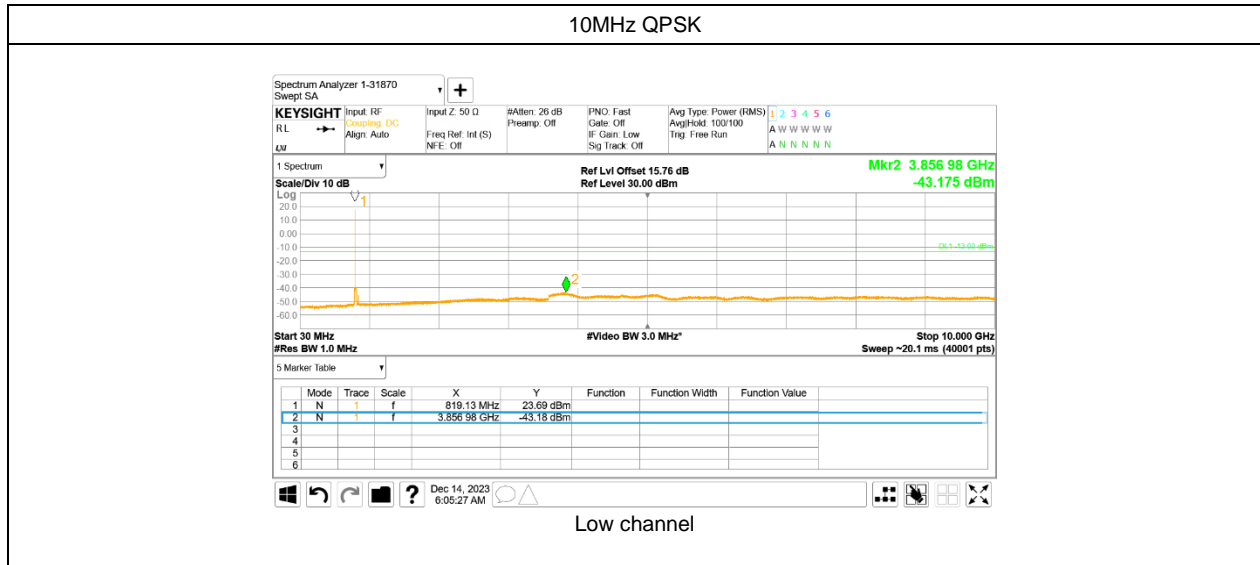
Mid channel



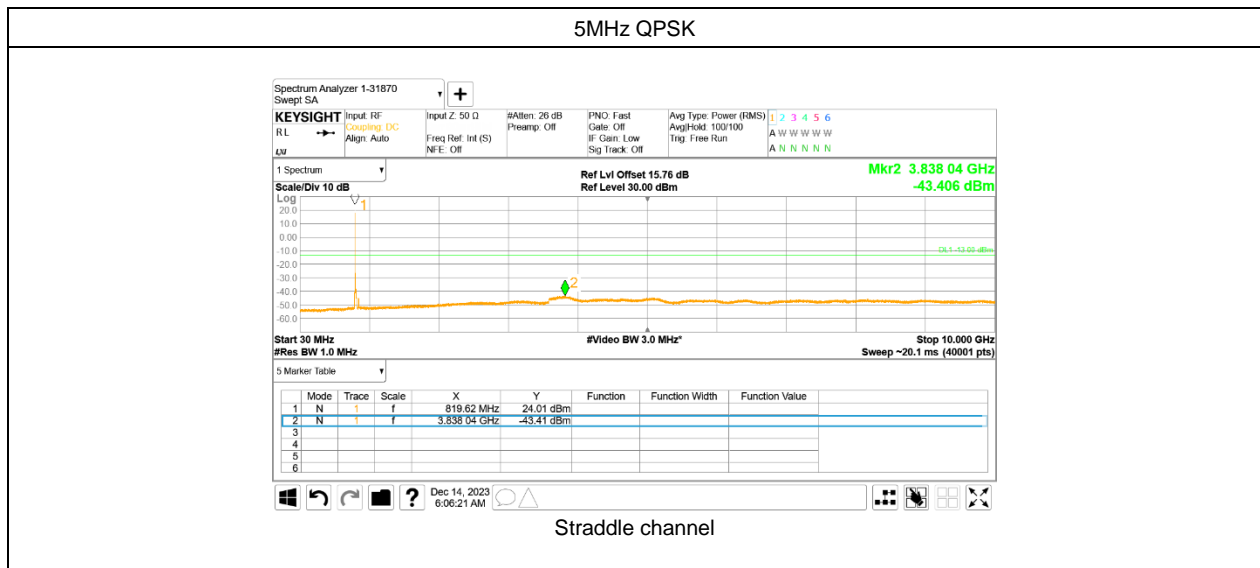
High channel



**LTE Band 26(Part 90)**

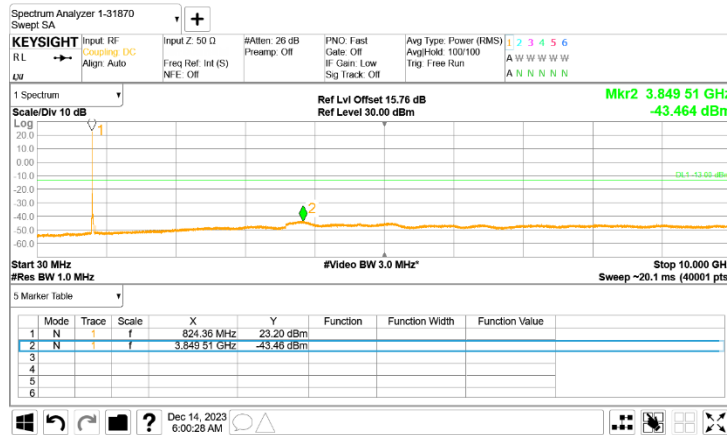


**LTE Band 26 (Straddle)**

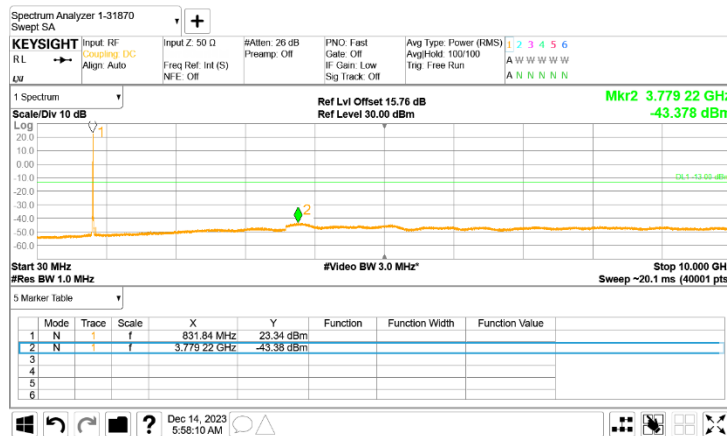


**LTE Band 26 (Part 22)**

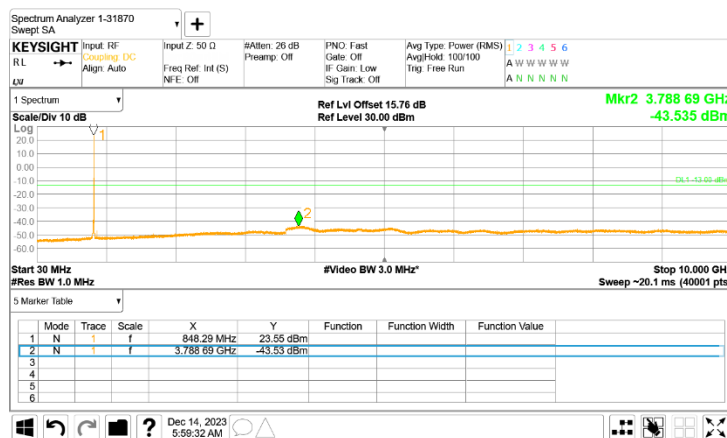
15MHz QPSK



Low channel



Mid channel



High channel

**NR Band n5**



## 8.6. FREQUENCY STABILITY

### RULE PART(S)

FCC: §2.1055, §22.355 and §90.213

### LIMITS

§22.355 - The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  ppm for mobile stations.

§90.213 - The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  ppm for mobile stations.

### 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 850, Channel 128/251, Frequency 824.2/848.8 MHz

Test Date	2023-12-01
Test Engineer	47989

Reference Frequency : GSM850 Low Channel 824.2 MHz / High Channel 848.8 MHz @ 20°C						
Limit: +/- 2.5 ppm =	Low Channel	2060.500	Hz	High Channel	2122.000	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
4.20	50	824.20012959	-0.134	848.80013088	-0.140	2.5
4.20	40	824.20012818	-0.133	848.80013958	-0.150	2.5
4.20	30	824.20001447	0.005	848.80001474	-0.003	2.5
<b>4.20</b>	<b>20</b>	<b>824.20001884</b>	<b>0.000</b>	<b>848.80001227</b>	<b>0.000</b>	<b>2.5</b>
4.20	10	824.20013010	-0.135	848.80013344	-0.143	2.5
4.20	0	824.20012251	-0.126	848.80011705	-0.123	2.5
4.20	-10	824.20012417	-0.128	848.80012546	-0.133	2.5
4.20	-20	824.20012711	-0.131	848.80013213	-0.141	2.5
4.20	-30	824.20016344	-0.175	848.80017903	-0.196	2.5

Reference Frequency : GSM850 Low Channel 824.2 MHz / High Channel 848.8 MHz @ 20°C						
Limit: +/- 2.5 ppm =	Low Channel	2060.500	Hz	High Channel	2122.000	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
4.20	20	824.20001884	0	848.80001227	0	2.5
4.40	20	824.20001294	0.007	848.80001083	0.002	2.5
3.80	20	824.20001484	0.005	848.80002120	-0.011	2.5

#### WCDMA Band 5

Test Date	2023-12-05
Test Engineer	47989

Reference Frequency : WCDMA Band 5 Low Channel 826.4 MHz / High Channel 846.6 MHz @ 20°C						
Limit: +/- 2.5 ppm =	Low Channel	2066.000	Hz	High Channel	2116.500	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
4.20	50	826.40000457	0.001	846.60000669	0.001	2.5
4.20	40	826.40000764	-0.003	846.60000736	0.000	2.5
4.20	30	826.40000531	0.000	846.60000492	0.003	2.5
<b>4.20</b>	<b>20</b>	<b>826.40000504</b>	<b>0.000</b>	<b>846.60000727</b>	<b>0.000</b>	<b>2.5</b>
4.20	10	826.40000386	0.001	846.60000342	0.005	2.5
4.20	0	826.40000600	-0.001	846.60000691	0.000	2.5
4.20	-10	826.40000688	-0.002	846.60000838	-0.001	2.5
4.20	-20	826.40000847	-0.004	846.60000716	0.000	2.5
4.20	-30	826.40000692	-0.002	846.60000894	-0.002	2.5

Reference Frequency : WCDMA Band 5 Low Channel 826.4 MHz / High Channel 846.6 MHz @ 20°C						
Limit: +/- 2.5 ppm =	Low Channel	2066.000	Hz	High Channel	2116.500	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
4.20	20	826.40000504	0	846.60000727	0	2.5
4.40	20	826.40000793	-0.003	846.60001862	-0.013	2.5
3.80	20	826.40000523	0.000	846.60001412	-0.008	2.5

**LTE Band 26**

Test Date	2023-12-08
Test Engineer	47989

Reference Frequency : Low Channel 824.7 MHz / High Channel 848.3 MHz @ 20°C							
Limit: +- 2.5 ppm =		Low Channel	2061.750	Hz	High Channel	2120.750	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]	
		Low Channel		High Channel			
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]		
4.20	50	824.70000616	-0.002	848.30001192	-0.009	2.5	
4.20	40	824.70000661	-0.002	848.30001346	-0.011	2.5	
4.20	30	824.70000449	0.000	848.30000519	-0.001	2.5	
<b>4.20</b>	<b>20</b>	<b>824.70000481</b>	<b>0.000</b>	<b>848.30000431</b>	<b>0.000</b>	<b>2.5</b>	
4.20	10	824.70000915	-0.005	848.30001856	-0.017	2.5	
4.20	0	824.70001593	-0.013	848.30001502	-0.013	2.5	
4.20	-10	824.70002647	-0.026	848.30002571	-0.025	2.5	
4.20	-20	824.70001930	-0.018	848.30001862	-0.017	2.5	
4.20	-30	824.70000720	-0.003	848.30001174	-0.009	2.5	

Reference Frequency : Low Channel 824.7 MHz / High Channel 848.3 MHz @ 20°C							
Limit: +- 2.5 ppm =		Low Channel	2061.750	Hz	High Channel	2120.750	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]	
		Low Channel		High Channel			
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]		
4.20	20	824.70000481	0	848.30000431	0	2.5	
4.40	20	824.70003204	-0.033	848.30002342	-0.023	2.5	
3.80	20	824.70003147	-0.032	848.30002377	-0.023	2.5	

**NR Band n5**

Test Date	2023-12-12
Test Engineer	25546

Reference Frequency : Low Channel 826.5 MHz / High Channel 846.5 MHz @ 20°C							
Limit: +- 2.5 ppm =		Low Channel	2066.250	Hz	High Channel	2116.250	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]	
		Low Channel		High Channel			
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]		
4.20	50	826.50000256	0.000	846.50000368	-0.002	2.5	
4.20	40	826.50000136	0.002	846.50000432	-0.003	2.5	
4.20	30	826.50000333	-0.001	846.50000217	-0.001	2.5	
<b>4.20</b>	<b>20</b>	<b>826.50000268</b>	<b>0.000</b>	<b>846.50000169</b>	<b>0.000</b>	<b>2.5</b>	
4.20	10	826.50000147	0.001	846.50000111	0.001	2.5	
4.20	0	826.50000135	0.002	846.50000239	-0.001	2.5	
4.20	-10	826.50000239	0.000	846.50000347	-0.002	2.5	
4.20	-20	826.50000365	-0.001	846.50000339	-0.002	2.5	
4.20	-30	826.50000337	-0.001	846.50000469	-0.004	2.5	

Reference Frequency : Low Channel 826.5 MHz / High Channel 846.5 MHz @ 20°C							
Limit: +- 2.5 ppm =		Low Channel	2066.250	Hz	High Channel	2116.250	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse				Limit [ppm]	
		Low Channel		High Channel			
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]		
4.20	20	826.50000268	0	846.50000169	0	2.5	
4.40	20	826.50000386	-0.001	846.50000281	-0.001	2.5	
3.80	20	826.50000252	0.000	846.50000211	0.000	2.5	

## 9. RADIATED RESULTS

### 9.1. RADIATED POWER (ERP)

#### RULE PART(S)

FCC: §2.1046, §22.913, and §90.635

#### LIMITS

22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

90.635(b) The maximum output power of the transmitter for mobile stations is 100 watts (20dBw).

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

#### 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  $\geq 2 \times$  RBW;
- 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, WCDMA), average(LTE, 5G NR);

#### TEST RESULTS

See the following pages.

### 9.1.1. ERP RESULTS

#### GSM (Antenna A, Main 1)

Band	Mode	Frequency (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	ERP (mW)	Limit (dBm)	Delta (dB)
GSM 850	GPRS	824.20	32.98	V	3.01	-1.03	28.94	783.43	38.50	-9.56
		836.60	33.65	V	3.03	-0.97	29.66	924.70	38.50	-8.84
		848.80	32.87	V	3.05	-0.91	28.91	778.04	38.50	-9.59
	EGPRS	824.20	27.72	V	3.01	-1.03	23.68	233.35	38.50	-14.82
		836.60	28.08	V	3.03	-0.97	24.09	256.45	38.50	-14.41
		848.80	27.79	V	3.05	-0.91	23.83	241.55	38.50	-14.67

#### WCDMA (Antenna A, Main 1)

Band	Mode	Frequency (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	ERP (mW)	Limit (dBm)	Delta (dB)
Band 5	REL99	826.40	23.15	V	3.01	-1.02	19.12	81.66	38.50	-19.38
		836.60	23.90	V	3.03	-0.97	19.91	97.95	38.50	-18.59
		846.60	23.59	V	3.05	-0.92	19.62	91.62	38.50	-18.88
	HSDPA	826.40	21.65	V	3.01	-1.02	17.62	57.81	38.50	-20.88
		836.60	22.38	V	3.03	-0.97	18.39	69.02	38.50	-20.11
		846.60	22.15	V	3.05	-0.92	18.18	65.77	38.50	-20.32

#### LTE Band 26 (Antenna A, Main 1)

BW (MHz)	Modulation	Frequency (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	ERP (mW)	Limit (dBm)	Delta (dB)	RB
15	QPSK	821.50	21.90	V	3.01	-1.04	17.85	60.95	50.00	-32.15	1/0
		824.00	22.04	V	3.01	-1.03	18.00	63.10	38.50	-20.50	1/0
		831.50	23.04	V	3.02	-0.99	19.02	79.80	38.50	-19.48	1/37
		836.50	22.91	V	3.03	-0.97	18.91	77.80	38.50	-19.59	1/0
		841.50	22.51	V	3.04	-0.94	18.53	71.29	38.50	-19.97	1/37
		846.50	22.51	V	3.04	-0.94	18.53	71.29	38.50	-19.97	1/37
	16-QAM	821.50	20.96	V	3.01	-1.04	16.91	49.09	50.00	-33.09	1/37
		824.00	21.02	V	3.01	-1.03	16.98	49.89	38.50	-21.52	1/0
		831.50	22.31	V	3.02	-0.99	18.29	67.45	38.50	-20.21	1/0
		836.50	21.81	V	3.03	-0.97	17.81	60.39	38.50	-20.69	1/0
		841.50	21.31	V	3.04	-0.94	17.33	54.08	38.50	-21.17	1/37
		846.50	21.31	V	3.04	-0.94	17.33	54.08	38.50	-21.17	1/37
10	QPSK	819.00	21.71	V	3.00	-1.06	17.65	58.21	50.00	-32.35	1/25
		824.00	22.05	V	3.01	-1.03	18.01	63.24	38.50	-20.49	1/0
		829.00	22.05	V	3.02	-1.01	18.02	63.39	38.50	-20.48	1/25
		831.50	23.39	V	3.02	-0.99	19.37	86.50	38.50	-19.13	1/0
		844.00	22.16	V	3.04	-0.93	18.19	65.92	38.50	-20.31	1/0
		844.00	22.16	V	3.04	-0.93	18.19	65.92	38.50	-20.31	1/0
	16-QAM	819.00	20.92	V	3.00	-1.06	16.86	48.53	50.00	-33.14	1/25
		824.00	21.01	V	3.01	-1.03	16.97	49.77	38.50	-21.53	1/25
		829.00	20.87	V	3.02	-1.01	16.84	48.31	38.50	-21.66	1/0
		831.50	22.24	V	3.02	-0.99	18.22	66.37	38.50	-20.28	1/25
		844.00	21.08	V	3.04	-0.93	17.11	51.40	38.50	-21.39	1/0
		844.00	21.08	V	3.04	-0.93	17.11	51.40	38.50	-21.39	1/0
5	QPSK	816.50	21.42	V	3.00	-1.07	17.35	54.33	50.00	-32.77	1/12
		821.50	21.28	V	3.01	-1.04	17.23	52.84	50.00	-31.63	1/0
		824.00	22.41	V	3.01	-1.03	18.37	68.71	38.50	-20.22	1/0
		826.50	22.31	V	3.01	-1.02	18.28	67.30	38.50	-19.16	1/24
		831.50	23.36	V	3.02	-0.99	19.34	85.90	38.50	-20.44	1/0
		846.50	22.03	V	3.05	-0.92	18.06	63.97	38.50	-21.80	1/12
	16-QAM	816.50	20.77	V	3.00	-1.07	16.70	46.77	50.00	-33.56	1/24
		821.50	20.49	V	3.01	-1.04	16.44	44.06	50.00	-32.83	1/0
		824.00	21.21	V	3.01	-1.03	17.17	52.12	38.50	-21.31	1/0
		826.50	21.22	V	3.01	-1.02	17.19	52.36	38.50	-20.20	1/24
		831.50	22.32	V	3.02	-0.99	18.30	67.61	38.50	-21.42	1/24
		846.50	21.05	V	3.05	-0.92	17.08	51.05	38.50	-21.42	1/24
3	QPSK	815.50	21.47	V	2.99	-1.07	17.41	55.08	50.00	-32.59	1/14
		822.50	21.34	V	3.01	-1.04	17.30	53.70	50.00	-32.70	1/0
		824.00	22.32	V	3.01	-1.03	18.28	67.30	38.50	-20.22	1/14
		825.50	21.56	V	3.01	-1.02	17.52	56.49	38.50	-20.98	1/0
		831.50	23.47	V	3.02	-0.99	19.45	88.10	38.50	-19.05	1/0
		847.50	22.18	V	3.05	-0.91	18.22	66.37	38.50	-20.28	1/0
	16-QAM	815.50	20.46	V	2.99	-1.07	16.40	43.65	50.00	-33.60	1/0
		822.50	20.88	V	3.01	-1.04	16.84	48.31	50.00	-33.16	1/8
		824.00	21.31	V	3.01	-1.03	17.27	53.33	38.50	-21.23	1/8
		825.50	20.61	V	3.01	-1.02	16.57	45.39	38.50	-21.93	1/14
		831.50	22.23	V	3.02	-0.99	18.21	66.22	38.50	-20.29	1/0
		847.50	20.95	V	3.05	-0.91	16.99	50.00	38.50	-21.51	1/0
1.4	QPSK	814.70	21.49	V	2.99	-1.08	17.42	55.21	50.00	-32.58	1/0
		823.30	21.40	V	3.01	-1.03	17.36	54.45	50.00	-32.64	1/0
		824.00	22.14	V	3.01	-1.03	18.10	64.57	38.50	-20.40	1/0
		824.70	21.47	V	3.01	-1.03	17.43	55.34	38.50	-21.07	1/0
		831.50	23.48	V	3.02	-0.99	19.46	88.31	38.50	-19.04	1/5
		848.30	22.20	V	3.05	-0.91	18.24	66.68	38.50	-20.26	1/3
	16-QAM	814.70	20.55	V	2.99	-1.08	16.48	44.46	50.00	-33.52	1/5
		823.30	20.65	V	3.01	-1.03	16.61	45.81	50.00	-33.39	1/3
		824.00	20.97	V	3.01	-1.03	16.93	49.32	38.50	-21.57	1/3
		824.70	20.07	V	3.01	-1.03	16.03	40.09	38.50	-22.47	1/3
		831.50	22.19	V	3.02	-0.99	18.17	65.61	38.50	-20.33	1/0
		848.30	21.17	V	3.05	-0.91	17.21	52.60	38.50	-21.29	1/0



**NR Band n5 (DFT-OFDM) (Antenna A, Main 1)**

BW (MHz)	Modulation	Frequency (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	ERP (mW)	Limit (dBm)	Delta (dB)	RB
20	QPSK	834.00	23.17	V	3.03	-0.98	19.16	82.41	38.50	-19.34	1/53
		836.50	23.29	V	3.03	-0.97	19.29	84.92	38.50	-19.21	1/53
		839.00	23.36	V	3.03	-0.96	19.37	86.50	38.50	-19.13	1/53
	16-QAM	834.00	22.19	V	3.03	-0.98	18.18	65.77	38.50	-20.32	1/53
		836.50	22.40	V	3.03	-0.97	18.40	69.18	38.50	-20.10	1/53
		839.00	22.39	V	3.03	-0.96	18.40	69.18	38.50	-20.10	1/53
15	QPSK	831.50	23.02	V	3.02	-0.99	19.00	79.43	38.50	-19.50	1/1
		836.50	23.24	V	3.03	-0.97	19.24	83.95	38.50	-19.26	1/1
		841.50	23.24	V	3.04	-0.94	19.26	84.33	38.50	-19.24	1/1
	16-QAM	831.50	21.95	V	3.02	-0.99	17.93	62.09	38.50	-20.57	1/1
		836.50	22.33	V	3.03	-0.97	18.33	68.08	38.50	-20.17	1/77
		841.50	22.25	V	3.04	-0.94	18.27	67.14	38.50	-20.23	1/1
10	QPSK	829.00	22.74	V	3.02	-1.01	18.71	74.30	38.50	-19.79	1/26
		836.50	23.24	V	3.03	-0.97	19.24	83.95	38.50	-19.26	1/1
		844.00	23.16	V	3.04	-0.93	19.19	82.99	38.50	-19.31	1/26
	16-QAM	829.00	21.77	V	3.02	-1.01	17.74	59.43	38.50	-20.76	1/26
		836.50	22.40	V	3.03	-0.97	18.40	69.18	38.50	-20.10	1/26
		844.00	22.19	V	3.04	-0.93	18.22	66.37	38.50	-20.28	1/26
5	QPSK	826.50	22.38	V	3.01	-1.02	18.35	68.39	38.50	-20.15	1/1
		836.50	23.19	V	3.03	-0.97	19.19	82.99	38.50	-19.31	1/1
		846.50	23.11	V	3.05	-0.92	19.14	82.04	38.50	-19.36	1/1
	16-QAM	826.50	21.32	V	3.01	-1.02	17.29	53.58	38.50	-21.21	1/23
		836.50	22.34	V	3.03	-0.97	18.34	68.23	38.50	-20.16	1/1
		846.50	22.04	V	3.05	-0.92	18.07	64.12	38.50	-20.43	1/1

## 9.2. RADIATED SPURIOUS EMISSION

### RULE PART(S)

FCC: §2.1053, §22.917, §90.543 and §90.691

### LIMIT

Part 22.917(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.

Part 90.543(f)

For operations in the 758–775 MHz and 788–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to –70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and –80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation

Part 90.691(a):

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

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10}(P)$  decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz. (NOTE : Use 100kHz reference bandwidth)

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

## **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 = 100 kHz for emission below 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(WCDMA, LTE, 5G NR), Maxhold(GSM);

### **NOTE1**

5G NR: All Waveforms (CP-OFDM vs DFT-s\_OFDM) and modulations ( $\pi/2$  BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

### **NOTE2**

Please refer to section 5.4 for bandwidth and RB setting about LTE, 5G NR bands.

## **RESULTS**

See the following pages.

### 9.2.1. SPURIOUS RADIATION RESULTS

#### GSM850

		UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement							
Company:		Samsung							
Project #:		4791082054							
Date:		2023-11-30							
Test Engineer:		28183							
Configuration:		EUT / AC Adapter, Z-Position							
Location:		Chamber 2							
Mode:		GPRS 850 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									
Antenna A									
Main 1									
Low Ch, 824.2MHz									
1648.40	-9.4	V	3.0	40.8	1.0	-49.3	-13.0	-36.3	
2472.60	-6.2	V	3.0	41.4	1.0	-46.6	-13.0	-33.6	
3296.80	-3.5	V	3.0	42.2	1.0	-44.7	-13.0	-31.7	
1648.40	-10.8	H	3.0	40.8	1.0	-50.6	-13.0	-37.6	
2472.60	-5.9	H	3.0	41.4	1.0	-46.3	-13.0	-33.3	
3296.80	-3.8	H	3.0	42.2	1.0	-45.0	-13.0	-32.0	
Mid Ch, 836.6MHz									
1673.20	-10.0	V	3.0	40.8	1.0	-49.9	-13.0	-36.9	
2509.80	-5.7	V	3.0	41.5	1.0	-46.1	-13.0	-33.1	
3346.40	-3.6	V	3.0	42.2	1.0	-44.8	-13.0	-31.8	
1673.20	-10.9	H	3.0	40.8	1.0	-50.7	-13.0	-37.7	
2509.80	-5.3	H	3.0	41.5	1.0	-45.7	-13.0	-32.7	
3346.40	-3.4	H	3.0	42.2	1.0	-44.6	-13.0	-31.6	
High Ch, 848.8MHz									
1697.60	-9.5	V	3.0	40.8	1.0	-49.3	-13.0	-36.3	
2546.40	-6.0	V	3.0	41.5	1.0	-46.5	-13.0	-33.5	
3395.20	-3.9	V	3.0	42.2	1.0	-45.1	-13.0	-32.1	
1697.60	-10.6	H	3.0	40.8	1.0	-50.4	-13.0	-37.4	
2546.40	-6.0	H	3.0	41.5	1.0	-46.6	-13.0	-33.6	
3395.20	-2.9	H	3.0	42.2	1.0	-44.1	-13.0	-31.1	

**WCDMA Band 5**

		UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement									
		f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
REL99 Antenna A Main 1	<b>Company:</b> Samsung										
	<b>Project #:</b> 4791082054										
	<b>Date:</b> 2023-12-04										
	<b>Test Engineer:</b> 28775										
	<b>Configuration:</b> EUT / AC Adapter, Z-Position										
	<b>Location:</b> Chamber 1										
	<b>Mode:</b> Rel99 Band 5 Harmonics										
	<b>Test Voltage:</b> AC 120 V, 60 Hz										
	<b>Low Ch, 826.4MHz</b>										
		1652.80	-15.3	V	3.0	43.3	1.0	-57.6	-13.0	-44.6	
		2479.20	-12.0	V	3.0	43.6	1.0	-54.5	-13.0	-41.5	
		3305.60	-9.6	V	3.0	43.9	1.0	-52.5	-13.0	-39.5	
		1652.80	-16.4	H	3.0	43.3	1.0	-58.7	-13.0	-45.7	
		2479.20	-12.3	H	3.0	43.6	1.0	-54.9	-13.0	-41.9	
		3305.60	-9.3	H	3.0	43.9	1.0	-52.2	-13.0	-39.2	
	<b>Mid Ch, 836.6MHz</b>										
		1673.20	-15.2	V	3.0	43.3	1.0	-57.5	-13.0	-44.5	
		2509.80	-11.9	V	3.0	43.6	1.0	-54.5	-13.0	-41.5	
		3346.40	-9.2	V	3.0	43.9	1.0	-52.1	-13.0	-39.1	
		1673.20	-16.3	H	3.0	43.3	1.0	-58.7	-13.0	-45.7	
		2509.80	-12.2	H	3.0	43.6	1.0	-54.8	-13.0	-41.8	
		3346.40	-9.1	H	3.0	43.9	1.0	-52.0	-13.0	-39.0	
	<b>High Ch, 846.6MHz</b>										
		1693.20	-15.1	V	3.0	43.3	1.0	-57.4	-13.0	-44.4	
		2539.80	-11.9	V	3.0	43.6	1.0	-54.5	-13.0	-41.5	
		3386.40	-9.0	V	3.0	44.0	1.0	-52.0	-13.0	-39.0	
		1693.20	-16.3	H	3.0	43.3	1.0	-58.6	-13.0	-45.6	
	2539.80	-12.1	H	3.0	43.6	1.0	-54.7	-13.0	-41.7		
	3386.40	-8.7	H	3.0	44.0	1.0	-51.7	-13.0	-38.7		

**LTE Band 26 (Part 90)**

		UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement									
		f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
15 MHz QPSK Antenna A Main 1	<b>Company:</b> Sasmsung										
	<b>Project #:</b> 4791082054										
	<b>Date:</b> 2023-12-11										
	<b>Test Engineer:</b> 28775										
	<b>Configuration:</b> EUT / AC Adapter, Z-Position										
	<b>Location:</b> Chamber 1										
	<b>Mode:</b> LTE_QPSK Band 26 Harmonics, 15MHz Bandwidth										
	<b>Test Voltage:</b> AC 120 V, 60 Hz										
	<b>Mid Ch, 821.5MHz</b>										
		1643.00	-15.2	V	3.0	43.3	1.0	-57.5	-13.0	-44.5	
		2464.50	-11.8	V	3.0	43.6	1.0	-54.4	-13.0	-41.4	
		3286.00	-9.4	V	3.0	43.9	1.0	-52.3	-13.0	-39.3	
		1643.00	-16.4	H	3.0	43.3	1.0	-58.7	-13.0	-45.7	
	2464.50	-12.1	H	3.0	43.6	1.0	-54.7	-13.0	-41.7		
	3286.00	-9.2	H	3.0	43.9	1.0	-52.1	-13.0	-39.1		

**LTE Band 26 (Straddle)**

UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement											
5 MHz  QPSK  Antenna A Main 1	Company: Samsung Project #: 4791082054 Date: 2023-12-11 Test Engineer: 28775 Configuration: EUT / AC Adapter, Z-Position Location: Chamber 1 Mode: LTE_QPSK Band 26 Harmonics, 5MHz Bandwidth Test Voltage: 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>Straddle Ch, 824MHz</b>										
	1648.00	-15.2	V	3.0	43.3	1.0	-57.5	-13.0	-44.5		
	2472.00	-11.8	V	3.0	43.6	1.0	-54.4	-13.0	-41.4		
	3296.00	-9.4	V	3.0	43.9	1.0	-52.3	-13.0	-39.3		
	1648.00	-16.2	H	3.0	43.3	1.0	-58.6	-13.0	-45.6		
	2472.00	-12.1	H	3.0	43.6	1.0	-54.7	-13.0	-41.7		
	3296.00	-9.1	H	3.0	43.9	1.0	-52.1	-13.0	-39.1		

**LTE Band 26 (Part 22)**

UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement											
1.4 MHz  QPSK  Antenna A Main 1	Company: Samsung Project #: 4791082054 Date: 2023-12-11 Test Engineer: 28775 Configuration: EUT / AC Adapter, Z-Position Location: Chamber 1 Mode: LTE_QPSK Band 26 Harmonics, 1.4MHz Bandwidth Test Voltage: 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>Low Ch, 824.7MHz</b>										
	1649.40	-15.2	V	3.0	43.3	1.0	-57.6	-13.0	-44.6		
	2474.10	-12.0	V	3.0	43.6	1.0	-54.6	-13.0	-41.6		
	3298.80	-9.5	V	3.0	43.9	1.0	-52.4	-13.0	-39.4		
	1649.40	-16.3	H	3.0	43.3	1.0	-58.7	-13.0	-45.7		
	2474.10	-12.3	H	3.0	43.6	1.0	-54.9	-13.0	-41.9		
	3298.80	-9.2	H	3.0	43.9	1.0	-52.1	-13.0	-39.1		
	<b>Mid Ch, 831.5MHz</b>										
	1663.00	-15.2	V	3.0	43.3	1.0	-57.5	-13.0	-44.5		
	2494.50	-12.0	V	3.0	43.6	1.0	-54.5	-13.0	-41.5		
	3326.00	-9.2	V	3.0	43.9	1.0	-52.1	-13.0	-39.1		
	1663.00	-16.4	H	3.0	43.3	1.0	-58.7	-13.0	-45.7		
	2494.50	-12.4	H	3.0	43.6	1.0	-54.9	-13.0	-41.9		
	3326.00	-9.1	H	3.0	43.9	1.0	-52.0	-13.0	-39.0		
	<b>High Ch, 848.3MHz</b>										
	1696.60	-15.0	V	3.0	43.3	1.0	-57.3	-13.0	-44.3		
	2544.90	-11.8	V	3.0	43.6	1.0	-54.4	-13.0	-41.4		
	3393.20	-8.9	V	3.0	44.0	1.0	-51.9	-13.0	-38.9		
	1696.60	-16.1	H	3.0	43.3	1.0	-58.5	-13.0	-45.5		
	2544.90	-12.0	H	3.0	43.6	1.0	-54.6	-13.0	-41.6		
	3393.20	-8.7	H	3.0	44.0	1.0	-51.6	-13.0	-38.6		

**NR Band n5**

		UL Verification Services, Inc. Above 1GHz High Frequency Substitution Measurement							
		<b>Company:</b> Samsung <b>Project #:</b> 4791082054 <b>Date:</b> 2023-12-05 <b>Test Engineer:</b> 27089 <b>Configuration:</b> EUT / AC Adapter, Z-Position <b>Location:</b> Chamber 2 <b>Mode:</b> 5G NR_QPSK NR n5 Harmonics, 20MHz 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
20 MHz									
DFT-OFDM									
QPSK									
Antenna A Main 1									
<b>Low Ch, 834MHz</b>									
1668.00	-15.0	V	3.0	40.8	1.0	-54.8	-13.0	-41.8	
2502.00	-11.9	V	3.0	41.5	1.0	-52.3	-13.0	-39.3	
3336.00	-9.1	V	3.0	42.2	1.0	-50.3	-13.0	-37.3	
1668.00	-15.7	H	3.0	40.8	1.0	-55.5	-13.0	-42.5	
2502.00	-11.7	H	3.0	41.5	1.0	-52.2	-13.0	-39.2	
3336.00	-8.7	H	3.0	42.2	1.0	-49.9	-13.0	-36.9	
<b>Mid Ch, 836.5MHz</b>									
1673.00	-14.9	V	3.0	40.8	1.0	-54.7	-13.0	-41.7	
2509.50	-11.7	V	3.0	41.5	1.0	-52.2	-13.0	-39.2	
3346.00	-9.0	V	3.0	42.2	1.0	-50.2	-13.0	-37.2	
1673.00	-15.7	H	3.0	40.8	1.0	-55.5	-13.0	-42.5	
2509.50	-11.6	H	3.0	41.5	1.0	-52.1	-13.0	-39.1	
3346.00	-8.6	H	3.0	42.2	1.0	-49.8	-13.0	-36.8	
<b>High Ch, 839MHz</b>									
1678.00	-14.8	V	3.0	40.8	1.0	-54.6	-13.0	-41.6	
2517.00	-11.8	V	3.0	41.5	1.0	-52.3	-13.0	-39.3	
3356.00	-8.9	V	3.0	42.2	1.0	-50.1	-13.0	-37.1	
1678.00	-15.6	H	3.0	40.8	1.0	-55.4	-13.0	-42.4	
2517.00	-11.7	H	3.0	41.5	1.0	-52.2	-13.0	-39.2	
3356.00	-8.4	H	3.0	42.2	1.0	-49.6	-13.0	-36.6	

**END OF REPORT**