

Review of Selected General Review and Approval Items

Office of Engineering and Technology
Laboratory Division

April 18, 2016: Updates following April 12, 2016
conference session shown in BLUE.



Outline

- Grant line entries
- Re-use of test data for device variations
- ANNEX – Examples



Form 731 Line Items–Basics

- Uniform grant listings give useful quick indications on transmit bands, powers, and emission types
- Scope of an equipment grant is established by representations and test data in application filing [§§ 2.907(a), 2.911(c), 2.915(a)(1), 2.927(b)]
- Grants are generally not available nor valid for device operations in numerous frequency bands used only outside of the U.S. and/or that do not fit within FCC allocations and paired bands
 - Example: 3GPP LTE band 3
 - Extended frequencies listing along with the required appropriate filing contents and grant comments is available for some but not for any/all bands
- Apply the key guidance on grant frequencies given in KDB Pub. 634817



Form 731 Line Items–Power

- Measured output power in watts is listed on grant for many devices
 - Maximum measured output power per emission type is listed
(listing “rated power” has other considerations; TCB please contact FCC Lab before grant)
 - Output power test data and compliance demonstration for all modes, emission types, and channels is in a filing *
 - Separate line entries for each emission designator, each frequency band, and varying device operating configurations
 - See also KDB Pub. 291699 about power test data across exhibits in a filing
- Power is usually listed in the same quantity as the applicable limit
 - Example: EIRP for Part 24 Subpart E portable station [§ 2.911(c), 2.1033(c)(7)]
(conducted power test data needed for § 2.1046 compliance, and for SAR text exclusion supporting information where applicable)
- Conducted power may be listed if:
 - Measurements can be made at antenna connector, and:
 - Service rule limit is in terms of conducted power
 - Allowed for licensed devices without specific antenna(s), for example:
 - 24E base station used with site-dependent tower-mounted antennas
 - Licensed-service module and module-like devices without specified antennas used in mobile-device and fixed-device RF exposure conditions
 - Allowed for module and module-like devices with specific antennas subject to radiated power limits (also list ERP/EIRP in grant comment)
 - Not allowed for end products with specific antennas and subject to ERP/EIRP limits; e.g., PCE, FRF

* See also *Miscellaneous Compliance Measurement Issues* presentation in this conference.



Form 731 Emissions–CMRS

- Uniform emission designator listing requirements for most CMRS devices (e.g., PCE parts 22/24/27) **have not been** established
- Emission symbol guidance includes:
 - F9W–CDMA; GXW–GSM; G7W–EDGE (8PSK); D7W–QAM; W7D–OFDM
- Typical 3GPP LTE symbols: D7W, G7D, G7W, W7D
- Listing only widest measured bandwidth per emission designator and per band allowed **for** 3GPP LTE modes where:
 - Power, bandwidth, and emission test data and compliance demonstration for all modes and channels is in **a** filing *
 - For each band, if mode with widest measured emission bandwidth has highest measured power, then single line entry per mode allowed
 - For each band, if mode with widest measured emission bandwidth does not have highest measured power, line entries needed for:
 - Widest measured emission bandwidth mode, with associated measured power
 - Highest measured power mode, with associated measured bandwidth

* See also *Miscellaneous Compliance Measurement Issues* presentation in this conference.



Form 731 Emissions–CA

- Carrier aggregation (CA), e.g., 3GPP E-UTRA –
- Emissions are designated according to their classification (symbols) and their *necessary bandwidth*, per § 2.201
 - By definition *necessary bandwidth* is the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions, for a given class of emission
- CA is intended to provide higher data rates
 - For example a 20+20 = 40 MHz LTE emission will have a higher data rate than a single component carrier LTE emission
- For CA modes where all component carriers **are** transmitted by a **single** device, such higher data-rate emissions should have additional Form 731 listings (e.g., 38M4G7W)
 - For contiguous intraband CA **emissions**, use measured occupied BW across component carriers and measured power
 - For noncontiguous intraband and interband CA **emissions**, use sum of measured occupied bandwidths of the individual carriers



Re-use of Test Data

- OET Lab has not established uniform policies and procedures on “re-using” test data from one version of a device for compliance demonstration of a modified version
 - This includes depopulated as well as similar but non-identical designs
 - The equipment authorization NPRM (FCC-15-92) has proposed a concept of “family of products” which would allow some test data re-use
- OET Lab may consider re-use on case-by-case bases subject to:
 - Intended variations must be identified within the initial filing for an FCC ID and [the re-use scheme](#) preapproved by FCC
 - Complete test data is required for all individual filings
 - Where test data is based on results from another filing, the original results must also be included in the new filing that is requesting re-use
 - Filings requesting re-use must include detailed cover letter: documenting compliance for the new device, and giving details and justification how and where original results demonstrate compliance for the new device
 - Sufficient verification test data must be provided with explanations to qualify the re-used results
 - A pre-TCB KDB inquiry request must be submitted and/or a TCB PAG submission including the test results and explanatory material per above
- [Separate considerations may apply for modular transmitters, per KDB Pub. 996369](#)

Note: See also, for example, KDB Pubs. 899624, 178919, 291699.



ANNEX

EXAMPLES



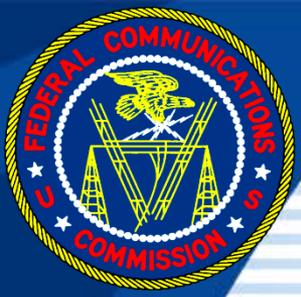
Example 1–3GPP LTE

Equipment Class : PCS Licensed Transmitter held to ear
Notes: Smart Phone with BT and WLAN

<u>FCC Rule Parts</u>	<u>Frequency Range (MHZ)</u>	<u>Output Watts</u>	<u>Frequency Tolerance</u>	<u>Emission Designator</u>
27	1710 - 1755	0.262	2.5 PPM	17M6G7W
27	1710 - 1755	0.204	2.5 PPM	17M6D7W
27	1710 - 1755	0.263	2.5 PPM	1M09G7W
27	1710 - 1755	0.207	2.5 PPM	1M07D7W

Output power listed is ERP for operations below 1 GHz and EIRP for operations above 1 GHz.
LTE supports 1.4/3/5/10/15/20 MHz modes in Band 4. ...

For the specific band, widest bandwidth (17M6) per emission does not have highest power, thus lesser bandwidth modes also listed.
[KDB Pub. 634817 D01 v04r01, III) a)]



Example 2–NII

Equipment Class : Unlicensed National Information Infrastructure TX
 Notes: BRIDGE/ROUTER

<u>Grant Notes</u>	<u>FCC Rule Parts</u>	<u>Frequency Range (MHZ)</u>	<u>Output Watts</u>	<u>Frequency Tolerance</u>	<u>Emission Designator</u>
38 CC MO	15E	5180 - 5240	0.93		
38 CC MO ND	15E	5260 - 5320	0.23		
38 CC MO ND	15E	5500 - 5700	0.22		
38 CC MO	15E	5745 - 5825	0.63		

... This device has 20/40/80 MHz bandwidth modes.

Kdb Pub. 634817 D01 v04r01 I) d): For devices capable of operating with multiple emission bandwidths in modes and/or channels based on IEEE Std 802.11 and/or its amendments, list the frequencies **tested** for the bandwidth that has the center frequencies closest to the band edges.

The Form-731 grant condition field should include a statement listing all bandwidth modes of operation (e.g., “This device has 20 MHz and 40 MHz bandwidth modes.”)



Example 3–Part 90 PLMRS

Equipment Class : Licensed Non-Broadcast Station Transmitter
 Notes: 2-Way Radio

<u>Grant Notes</u>	<u>FCC Rule Parts</u>	<u>Frequency Range (MHZ)</u>	<u>Output Watts</u>	<u>Frequency Tolerance</u>	<u>Emission Designator</u>
EF	90	406.1 - 470	0.942	0.41 PPM	10K2F3E
EF ES	90	406.1 - 470	0.977	0.39 PPM	7K65FXW
EF ES	90	406.1 - 470	0.973	0.39 PPM	7K67FXD
EF ES	90	406.1 - 470	0.968	0.53 PPM	3K66FXW
EF ES	90	406.1 - 470	0.961	0.53 PPM	3K65FXD

At the time of grant, the following frequency bands were generally available for part 90 licensing and operation:

f_lo MHz	f_hi MHz
406.1	410
410	420
450	454
456	460

f_lo MHz	f_hi MHz
460	462.5375
462.7375	467.5375
467.7375	470



Example 4–TNB CMRS (1)

2110 MHz to 2180 MHz frequency band.

Test Case	Description	Requirements	Result
AWS Band			
2.1046 27.50(d)(1)-(3) KDB 971168 D01 (5.1.1)	RF power output	EIRP not exceed 1640 W	Pass
2.1047 KDB 971168 D01 (3)	Modulation characteristics	Digital modulation	Pass
27.50(d)(5) KDB 971168 D01 (5.7.1)	Peak-to-average power ratio (PAPR)	Peak-to-average power ratio not exceed 13 dB	Pass
2.1049 27.53(h)(3) KDB 971168 D01 (4.1)	Emission bandwidth (26 dB)	Emission bandwidth below 26 dB	Pass
2.1049(h)	Occupied bandwidth (99 %)	(not specified)	Pass
2.1051 27.53(h)	Band edges compliance	Below -13 dBm / 1%*EBW, in 1 MHz range	Pass
2.1051 27.53(h) KDB 971168 D01 (6)	Spurious emissions at antenna terminals	Below -13 dBm from 9 kHz to 10 th harmonics	Pass
2.1053 27.53(h) KDB 971168 D01 (7)	Field strength of spurious radiation	Below -13 dBm from 9 kHz to 10 th harmonics	Pass
2.1055 27.54 KDB 971168 D01 (9)	Frequency stability	Stay within the authorized bands of operation	Pass

Typical minimum info for scope / summary portion of a test report [§§ 2.911(c), 2.1033(a)] (i.e., all part 2 and relevant part 27 sections listed somewhere in test report); other or different details may apply. Rule section and compliance demonstration explanation should also be listed with each set of test data.



Example 4–TNB CMRS (2)

Description	Channel bandwidth (MHz)				Modulation			Channel			Antenna	
	5	10	15	20	QPSK	16QAM	64QAM	B	M	T	1	2
RF output power	X	X	X	X	X	X	X	---	X	---	X	X
Modulation characteristics	X	X	X	X	X	X	X	---	X	---	X	X
Peak to average ratio	X	X	X	X	X	X	X	---	X	---	X	X
Emission bandwidth (99 % and 26 dB)	X	X	X	X	X	X	X	---	X	---	X	X
Band edges compliance	X	X	X	X	X	X	X	X	---	X	X	X
Spurious emissions at antenna terminals	X	X	X	X	X	X	X	---	X	---	X	X
Field strength of spurious radiation	---	---	---	X	---	---	X	---	X	---	X	X
Frequency stability, temperature change	---	---	---	X	---	---	X	---	X	---	X	---
Frequency stability, voltage change	---	---	---	X	---	---	X	---	X	---	X	---

X measured
 --- not measured

Pre-measurements have been done to find out the worst case from the RF output power point of view, as shown in the table. The following settings were found and they are considered as representative for the performed measurements. This corresponds to the maximum load. Please note, only the diagrams from antenna port 1 are shown in this test report. The diagrams from antenna port 2 are similar. Please refer to the test result tables.

Typical minimum info that has been accepted for modes and channels selection; other or different details may apply.



Example 5–Emission Symbols

- (https://www.itu.int/en/ITU-R/terrestrial/workshops/RRS-13-Americas/Documents/Systems_ClassofEmissions_RRS13.pdf)
 - Radiocommunication services/ examples of systems; Mobile service: GSM (2G), GPRS (2.5G), EDGE (2.75G), UMTS (3G)
 - Description of emissions: Phase modulation multichannels containing quantized or digital information
 - Classes of emission: G7W
- Rep. ITU-R M.2039-2, Table 3
 - UTRA base 5M00V7WEC; E-UTRA base 5M00V7WEW, etc.
- § 2.202(g), PSK: G7D
- Rec. ITU-R SM.1138-2,
 - Orthogonal frequency division multiplexing (OFDM) or coded OFDM (COFDM),
 - Data sub-carriers can be BPSK, QPSK, QAM modulated: 16M6W7D
- First symbol
 - F: Frequency modulation
 - G: Phase modulation
 - V: A sequence of pulses which is a combination of the types K, L, M, Q or is produced by other means [§ 2.201(c)(5)]
 - W: Cases not covered by types A to V, which consists of the main carrier modulated, either simultaneously or in a pre-established sequence, in a combination of two or more of the following modes: amplitude, angle, pulse [§ 2.201(c)(6)]
- Second symbol
 - 1: Single channel containing quantized or digital information without the use of a modulating sub-carrier, excluding TDM
 - 3: Single channel containing analog information
 - 7: Two or more channels containing quantized or digital information
 - 9: Composite system with one or more channels containing quantized or digital information, together with one or more channels containing analog information
 - X: Cases not otherwise covered
- Third symbol
 - D: Data transmission, telemetry, telecommand
 - E: Telephony (including sound broadcasting)
 - W: Combination of information types A to F [§ 2.201(e)]